THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXV. No. 2129.] LONDON, MARCH 1, 1904. [56TH YEAR. PRICE 6d.

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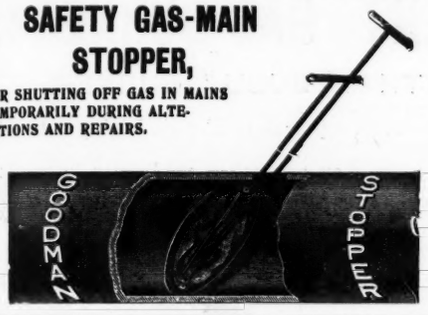
FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.



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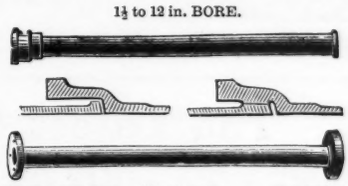

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The following Town Water-Works Supplies have been obtained by this System, viz. :—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.

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MELDRUM'S PATENT

RETORT SCURFER

Saves its Cost many times each Year.

TESTIMONIAL.

Gas Office, Longwood,
Huddersfield, *Dec. 10th*, 1903.

Messrs. MELDRUM BROS., LTD., Timperley.

GENTLEMEN,

We have now had your Retort Scurfer at these Works for over Twelve Months, and having tried several forms of de-scurfing Retorts, we have no hesitation in saying that it is by far the best Apparatus we have tried for this purpose. **Two men have several times drawn a Setting of Seven Retorts, thoroughly cleaned the same, and charged the Retorts again within 6½ hours.** As a matter of fact, it is unnecessary for a Retort to be out of use more than 40 minutes for scurfing purposes if your apparatus is used.

After being subjected to the blast of steam and air which is injected, the scurf is easily removed with a bar without violence and consequent damage to the Retort itself.

I am, yours faithfully,
(Signed) J. H. BREARLEY.

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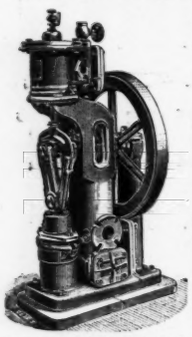


Fig. 705. "SINGLE RAM" STEAM-PUMP.

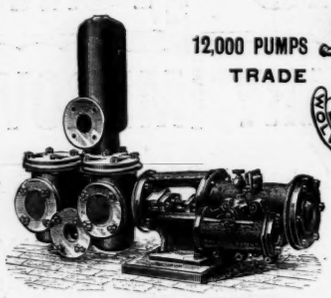


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

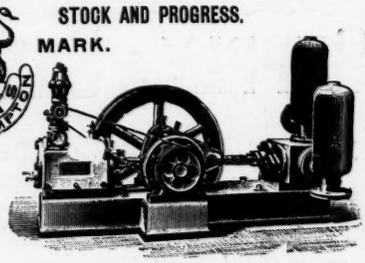


Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

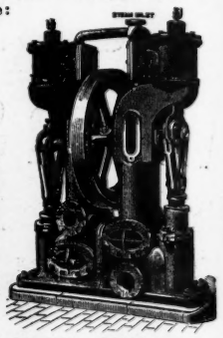
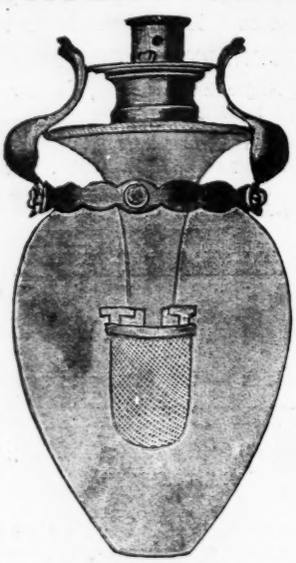


Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

The Latest Novelty in Gas Lighting is the

PATENT INVERTED INCANDESCENT GAS-BURNERS.



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Price: Burner with Mantle, **6/6.**
Globes from **8d.** each.

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The most up-to-date and economical system of gas lighting, artistic in appearance and absolutely shadowless, and readily attached to existing fittings.

A BRILLIANT WHITE LIGHT OF 65 STANDARD CANDLE POWER.

Gas Consumption only 3 cubic feet per hour.

The decorative appearance of Electric Light at one-tenth the cost.

THE "BIJOU" BURNER

Is the nearest approach to Electric Light, and lends itself more than any other gas-burner to private house lighting, having an exceedingly pretty effect when fixed in clusters of 2, 3, or 5 lights.

20 standard candle power.

Consumption of Gas, 1 foot per hour.

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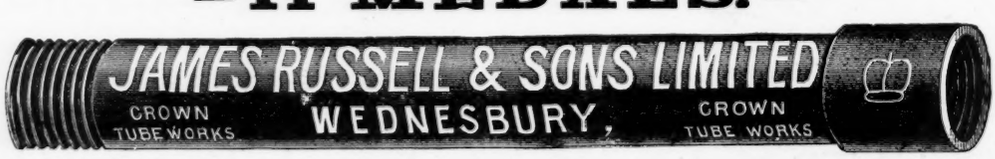

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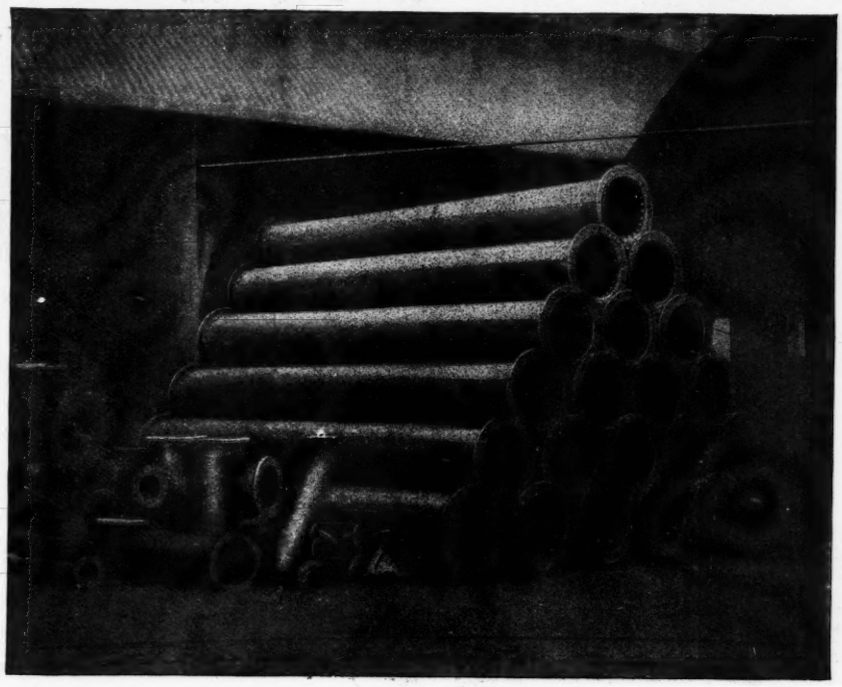

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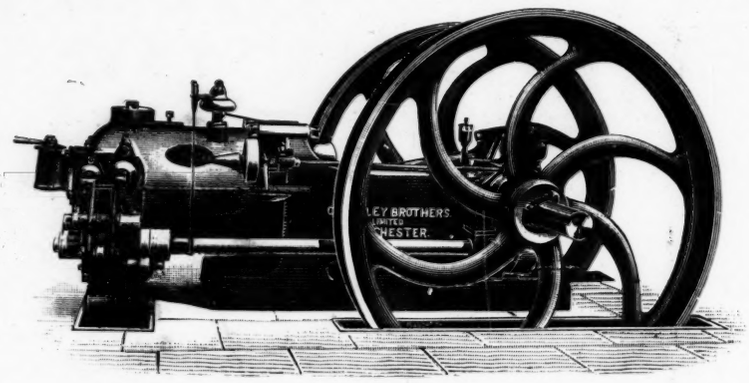

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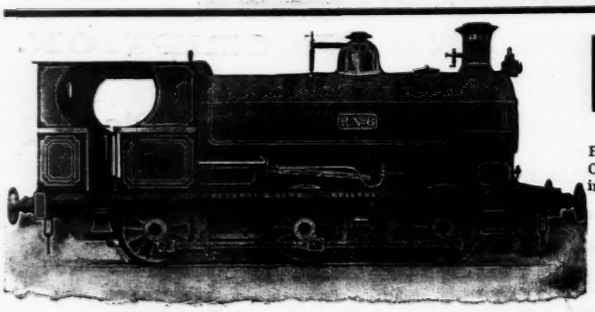

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No. 6 B. 3-LIGHT.

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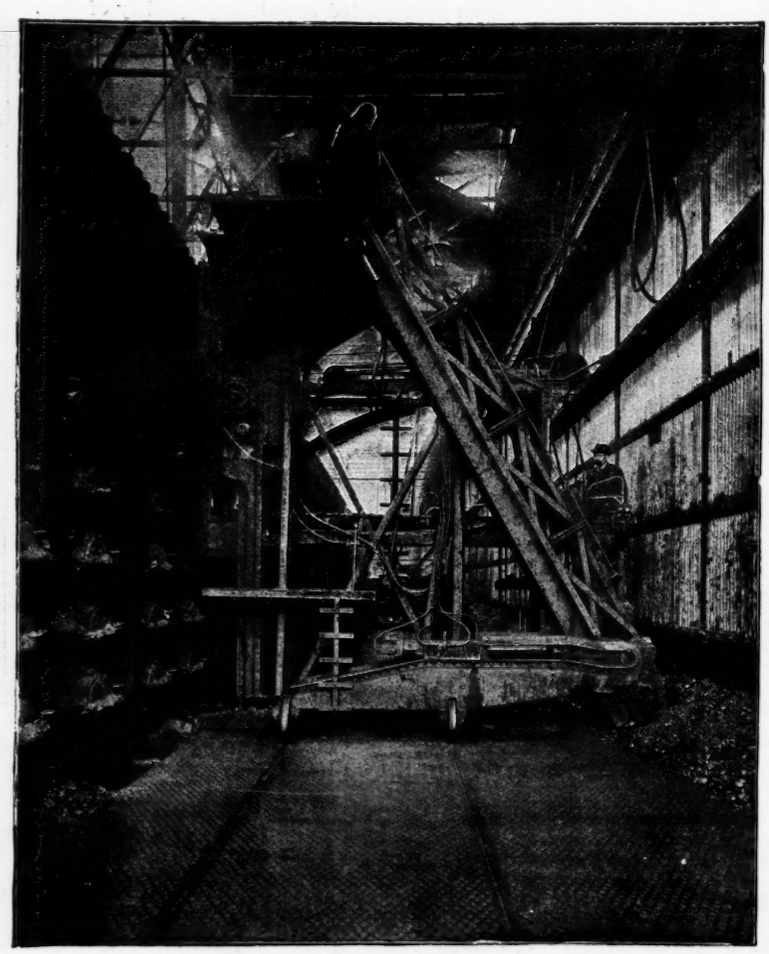

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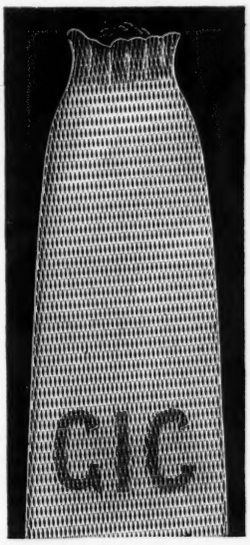

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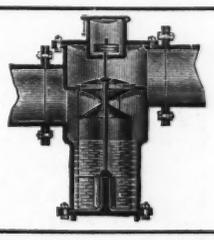

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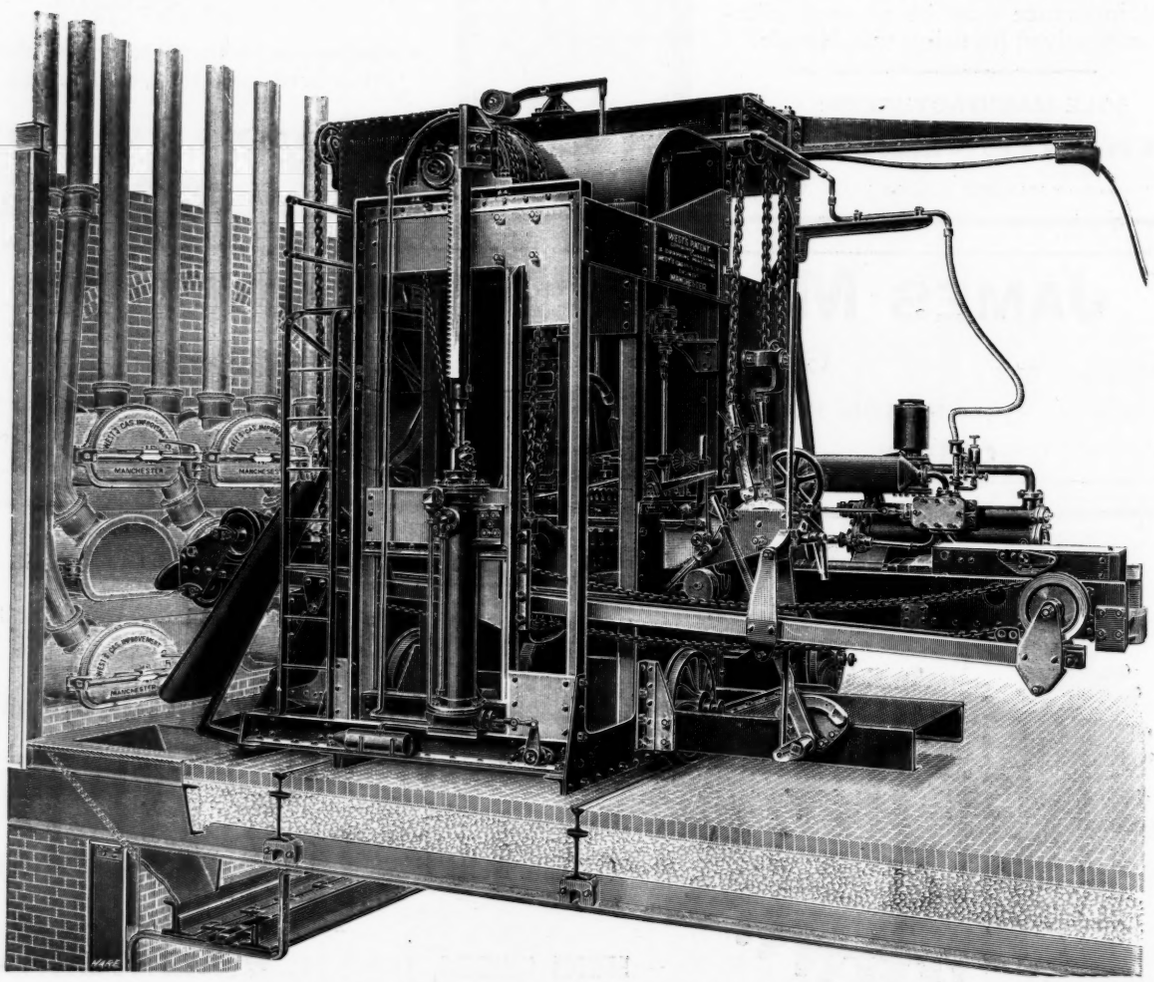

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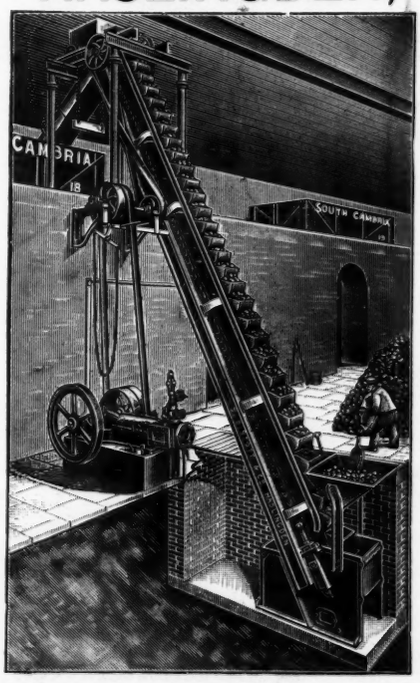

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BURY	1,000,000	PINNER	250,000
SUTTON	1,000,000	HERNE BAY	250,000
GLOUCESTER	1,000,000	PELTON COLLIERY	250,000
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PATENT "STANDARD" WASHER-SCRUBBERS

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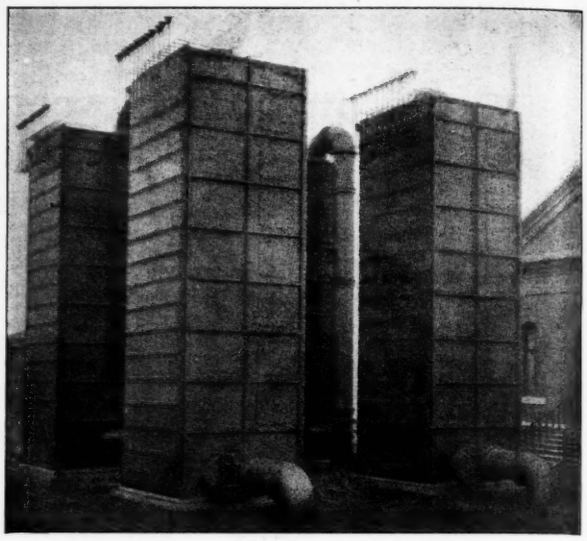

Patent "Standard" Condensers at Provan Works, Glasgow, 12,000,000 cubic feet per day capacity.

ABSORPTION OF FOUL GASES.

(HEMINGWAY'S PROCESS.)

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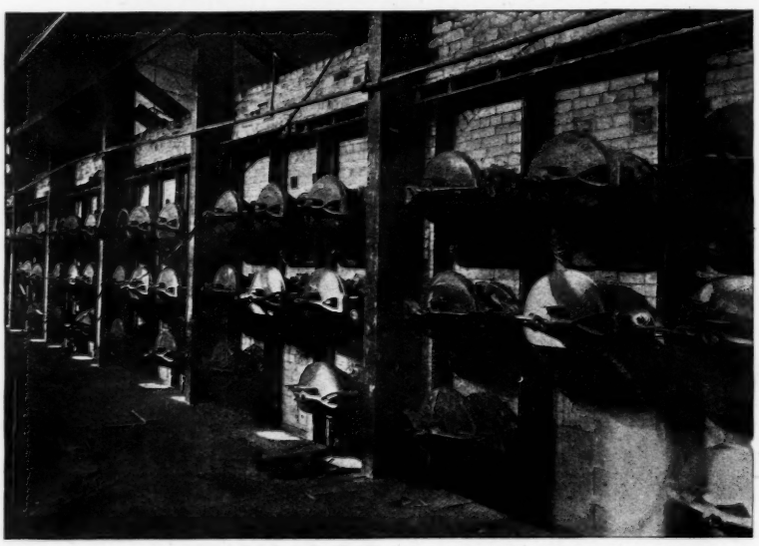

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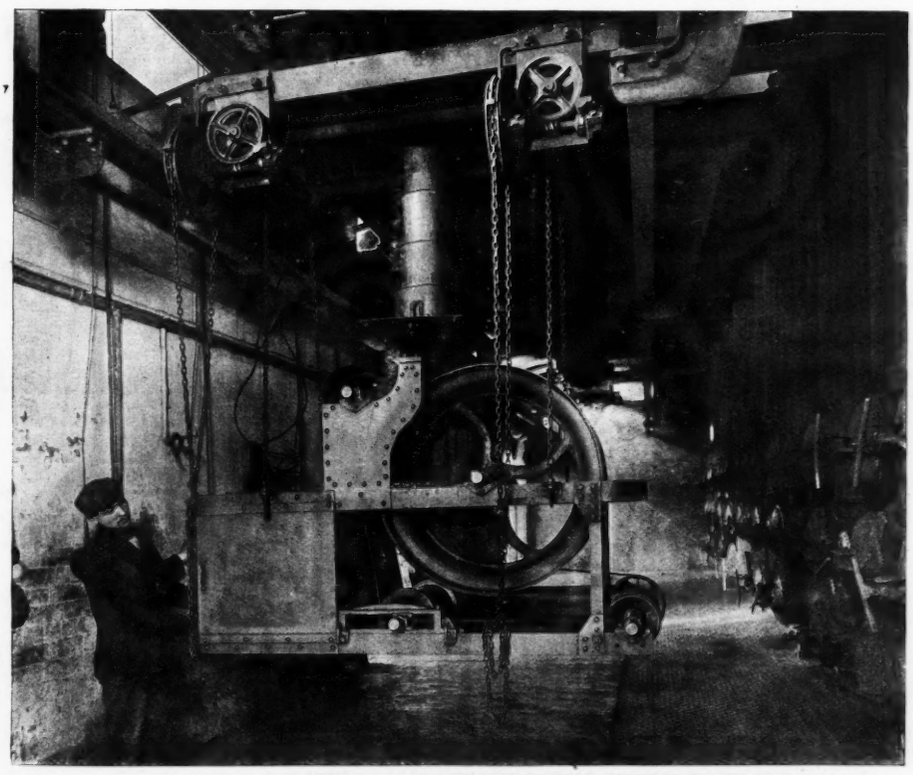

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CONTENTS.

EDITORIAL NOTES.

GAS, &C.—
Affiliation 519
An Address and a President of Many Parts 519
The Manchester Institution—Criticisms of Manchester Retort-House Practice . . 520
The Lords and the Metric System . . . 520
The Discounts of the Gaslight and Coke Company 521
Recent Nuisance Cases and their Lesson . 521
The Marylebone Muddle in Parliament . 522
The Acetylene Association and Its Labours—A Junior Gas Association and the Adoption of the Question-Box—The Retort Discourteous—And Some Curious Figures . 522
WATER AFFAIRS—
The Metropolitan Water Arbitration . . 523

ESSAYS AND REVIEWS.

The Public Lights of London 524
Gas and Water Stock Market 526
The Smell of Imperfectly-Burnt Gas . . . 526
Presentation to Mr. J. W. Helps 527
The West Combined Charging and Drawing Machine 527
Electric Lighting Memoranda 529

COMMUNICATED ARTICLE.

Heat-Conduction through Brickwork. By George Beilby 530

PARLIAMENTARY INTELLIGENCE.

House of Lords—Progress of Bills 567
House of Commons—Rejection of the Rickmansworth and Uxbridge Valley Water Bill; Progress of Bills 567

LEGAL INTELLIGENCE.

The Marylebone Electric Lighting Question. 568
Unfounded Charge of Unlawfully Using Gas 568

TECHNICAL RECORD.

Midland Association of Gas Managers—The Annual Meeting at Birmingham—
General Business 531
The Affiliation Question 531
Inaugural Address of Mr. George Helps . 533
Mr. S. O. Stephenson on Gas-Fires. . . 541
Manchester District Institution of Gas Engineers—Annual Meeting in Manchester—
General Business 545
Inaugural Address of Mr. H. Townsend . 545
Mr. J. G. Newbigging on Horizontal *v.* Inclined Retorts and Coke Conveying . . 551
Mr. H. Kendrick on Carburetted Water Gas Workings. 556
Manchester and District Junior Gas Association 561
London and Southern District Junior Gas Association—The Competition of Electricity with Gas. 562
The Acetylene Association 544

REGISTER OF PATENTS.

Water-Gas Apparatus—Bauke and Fuchs . 564
Automatically Extinguishing Gas-Lights after they have Burnt a Given Length of Time—Abel, C. D. (La Compagnie Anonyme Continentale pour la Fabrication des Compteurs de Gaz et Autres Appareils) 564
Coin-Freed Gas-Meters—Glover, W. R. . . 564
Hot-Coke Conveyors—Graham, M. . . . 565
Utilizing Spent Lime and Clinkers for Brick Making, &c.—Lowden, J. 565
Retort-Charging Scoops—West J., and Carpenter, W. J. 566
Combined Water-Gas and Coal-Gas Producers—Boult, A. J. (Goldschmid, J. E.) . 566
Gas Generator—Kiderlen, A. E. 566
Incandescent Burner with Oxygen Supply—Tresenreuter, G. 567
Patent Notices 567

MISCELLANEOUS NEWS.

Nantwich Gas Arbitration 568
East Dereham Gas Supply—Local Government Board Inquiry 570
Bromley Gas Consumers' Company . . . 571
Bournemouth Gas and Water Company . . 571
Ascot District Gas Company 572
Provincial Gas and Water Companies. . . 573
Incandescent Gas Lighting in Westminster . 574
Southport Corporation Gas Undertaking—Appointment of Mr. Bond as Engineer; Extensions at the Gas-Works 574
Mr. W. R. Herring on "Bad Gas and How to Improve It" 574
The Marylebone Electric Lighting Question. 575
Metropolitan Water Arbitration 576
Stock and Share List 576
The Illuminating Power of Godalming Gas . 577
Regulation of Gas Supply in New York . . 577
Notes from Scotland 578
Current Sales of Gas Products 580
Coal Trade Reports 581

PARAGRAPHS.

Death of Mr. A. H. Cane, of Reading—Mr. Charles Meiklejohn—The Coal Tests in the Settle-Padfield Experimental Retort—Gas *v.* Electricity for Shop Lighting 524
London County Council's Gas Bill to be Withdrawn 527
The Subway System in Scotland 576
The Richmond Gas Stove and Meter Company 579
Sales of Shares—New Purifiers and Jäger Grids for the Rochester Gas-Works—Penzance Water-Works—The Recent Fire in Baltimore. 581
Reductions in Price—Some Large High-Pressure Incandescent Gas Installations—The Gaslight and Coke Company's Discounts—Cheap Electricity for Leeds Streets—Gas Lighting in West Ham—Lead Poisoning and Water Supplies 582
The Thames and the London Water Supply—Gas-Engines for Pumping. 583

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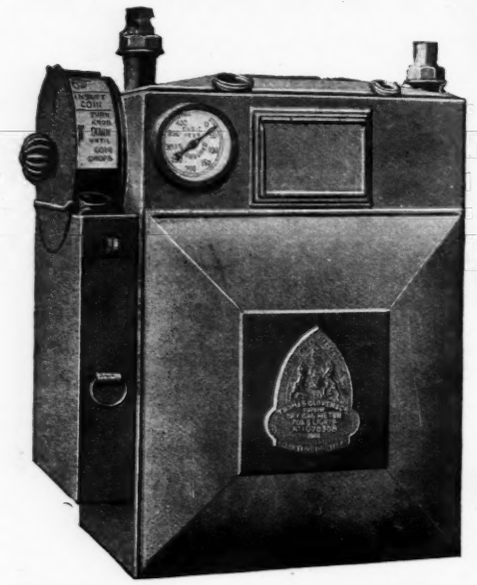

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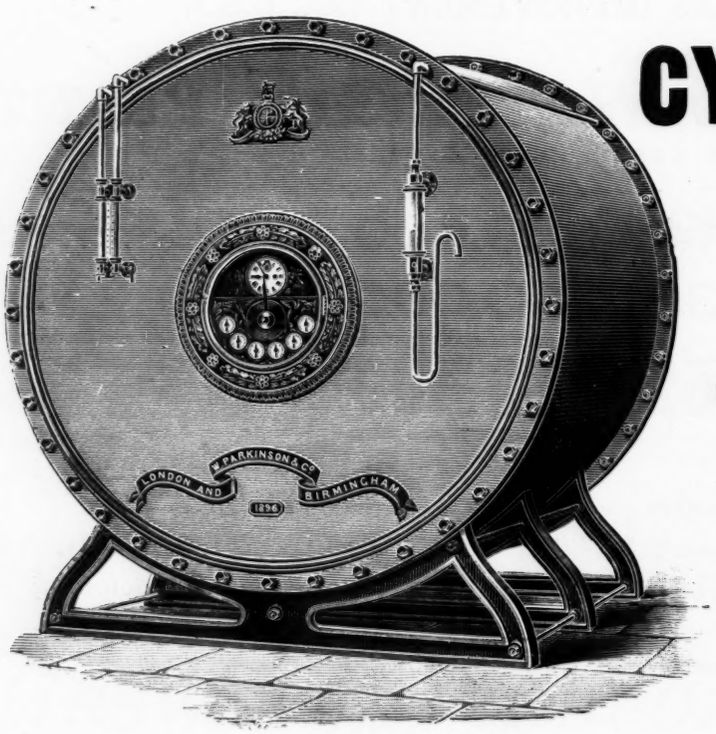

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VOL. LXXXV., No. 2129.—TUESDAY, MARCH 1, 1904.

EDITORIAL NOTES—GAS, &c.

Affiliation.

THE question of affiliation is only at the present time discussable, at meetings of the District Associations, on points of detail, for the purpose of taking the sense of the members to serve as an instruction to each President representing the interests of his own organization on the Special Committee which the Institution of Gas Engineers have appointed with the object of formulating a concrete scheme. This Committee is really the outcome of a suggestion of the Committee of the Manchester Institution. The resolution incorporating it was approved by the members of the latter body by the adoption of the annual report at the meeting on Saturday; but there was no discussion on it—it being considered that no good would be gained by spending time in talking over the general subject before the Committee of the central Institution have reported.

The Committee and members of the Midland Association were of the contrary opinion; and, at their meeting on Thursday, there was a useful discussion of points affecting the question. In the result, the members endorsed certain recommendations of their Committee, which will be found set out in the report of the opening speech on the matter of the retiring President (Mr. Charles Meiklejohn). There is nothing hard and fast about these recommendations; and they will not in any way cramp the proceedings of the Special Committee of the central Institution. Rather, we conceive that the views expressed, and the suggestions made, will be of great assistance as supplying a base on which the Special Committee will be able to work at their conferences. It will be better for the Committee to approach their task with the feelings of the various District Associations in their possession, than to have any provisional scheme roughly torn about on its very first submission to the latter. It cannot be expected that any scheme will be in such a complete form at the outset that it will be in every respect unanimously agreed to; but it may as well be brought as near as possible to the condition that will be most generally acceptable. In view of this, other Associations who will be meeting shortly will, we feel, be rendering help by following the example of the Midland Association. The members need not fear that there will be anything definitive about any action of this kind, as the scheme which issues from the Special Committee must be tendered to each Association for acceptance or otherwise.

One thing is abundantly plain, that the Articles of Association of the Institution do not admit of affiliation precisely in the manner in which the District Associations will alone be prepared to attach themselves to the central organization. The Institution at present have the power to form Local Sections; but the Associations, so far as the views of the members have been disclosed, will not be willing to sacrifice their liberty of self-government in any way. And there is no reason why they should. The point has been much debated as to what will be the position of those members of District Associations who are disqualified from membership of the Institution. Affiliation of the Associations will not confer any special benefits upon individuals in regard to membership of the Institution save so far as the remission of the entrance fee is concerned; but no one can become a member of the Institution whose qualifications do not comply with the terms distinctly set out in the Articles of Association. The point as to any person who happens to be President for the time being of an Association, but who is not qualified for membership of the central Institution, not being able to represent the local organization on the Council, can easily be legislated for by provision being made for the delegation of the duty to an official of the Association who is qualified. It is clear from one statement made by Mr. Meiklejohn at the Midland meeting that affiliation would be a source of additional strength to the Institution, as more than half the members of the Associations are not members of the central organization.

An Address and a President of Many Parts.

THERE can be no two questions about it that the feature of last Thursday's meeting of the Midland Association was the address with which Mr. George Helps inaugurated his year of office. It was a remarkable composition, both for its length and the variety of the subjects which the volatile mind of the President had brought within it. Even the length and the isolated deductions which do not seem to cog nicely with the premises, can be forgiven, in view of the originality which is found in almost every paragraph. Mr. Helps is a man of strong convictions, and has a decidedly expressive manner of stating and urging them. And these characteristics are so deeply lined throughout the address that everybody identified with the gas industry, and no matter what his favourite topic, will certainly find something which, if it does not altogether please his fancy, will certainly have interest for him.

The first controversial matter is found in his remarks as to the advantages of gas engineers associating themselves with gentlemen connected with allied industries; and if in what he says here the wheat is separated from the chaff, the line is drawn which, if it could have been found years ago, would have prevented that cleavage in the profession which was so universally lamented, but so difficult to seal up. It is not intended to be hypercritical over the small points of an address which contains so much that is good. But when Mr. Helps moralizes, he makes use of occasional loose expressions which, did one wish to be discursive, might be the subject of friendly criticism. For example: "We know that there is "very much wickedness in the outer world, and of necessity "so"—— Hold! Why "of necessity so"? "But the "cutting ourselves off from it does not improve the outer "world or us." Does the "it" refer to the "wickedness" or to the "outer world"? If the former, then Mr. Helps, who is fond of maxims, will be well aware of the one regarding what befalls the man who touches pitch. Just one more sentence: "If it be known that certain practices are looked "on with disfavour and discountenanced by those who "should discountenance them, they will cease to be prac-"tised." This is enough to make one rub his eyes to see that they have not deceived him. "If it be known!" Well, in all conscience, sufficient has been done to make it known that "certain practices are looked upon with disfavour;" and yet they do not cease. So long as there are two parties willing from their respective sides to continue "certain "practices," so long will those practices exist.

We do not think that Mr. Helps's scheme for the avoidance of the election of impossible or unnecessary members to the gas organizations would be any improvement on present methods. A dozen "Fellows," or whatever other dignified title might be found for them, would not—judging from experiences not yet twelve months old—care about the responsibility which the President suggests should be imposed on them. It is difficult to see how those "Fellows" could better in any way the present system of submitting all applications for membership to Councils or Committees. If the idea of the President is to throw the door open wider, then other means would first have to be taken to enlarge the powers of the various organizations, which powers could be just as well administered by the present Executives as by a new creation. Then, hinging on this same subject, the President spoke later on of the practice that has grown up lately of contracting firms purchasing shares in gas undertakings for the purpose of influencing orders or wreaking their vengeance on some unfortunate who has displeased them. It would be an extremely interesting thing to have a proved example of the latter action to discuss; but it would become no one to inveigh against firms investing, for the one legitimate purpose, the surplus profits in an industry out of which they have made them. In this there is no harm whatever, but rather a proof of their confidence.

Turning from general matters to those of a more particular character, it is easy to agree at once with much that the President has to say, and which he says well. Where doubt may exist, it would be unfair to an address that has

manifestly been a matter of considerable thought, study, and research to adversely criticize without bestowing upon it an equal amount of those three necessaries to the production of sound reasoning. Speaking generally, the President's views on the subject of low-power gas, cheap power, and the necessity for a vigorous policy in these days, harmonize with our own; but we are not of those who consider that things have really come to such a pass in the gas industry that this extraordinary dogmatic assertion can be readily attested: "Unless definite action be taken, we shall find "ourselves with an Act of Parliament, and a gas-works "and distributing-mains for supplying an illuminating gas "for which there is no demand." Later on, it is seen that "power is the citadel we have to capture." The truth of this is, of course, though not so stated, confined to localities; and while this citadel may be the only one that has to be captured in those localities, it is none the less a fact that there are other citadels that require a certain amount of energy expended in their defence—even against the President's attack. The affording of facilities for expanding business beyond the mains may be named.

If we read the President rightly, he is in favour of carbonizing coal in coke-ovens at the pit's mouth, and distributing it at high pressure to the various districts of supply. When these things come to pass, then the millennium of the gas supplier will be here; there will be no more sorrow for the gas engineer, and all remembrance of past worries will be lost under the soothing influence of larger salaries! But the start with the foundation of this happy condition of things must be made somewhere. Why not at Nuneaton? Before the start, however, let us remind the President of one point, and that is, under the new order of things, among the changes that must necessarily follow will be the requirement of fewer works and fewer gas engineers. The "larger salaries" will be the reward of but the comparatively few; the remainder of Mr. Helps's professional brethren will perhaps be among the unemployed. Those who fancy they may be of the latter will be the ones who will hope that the President's chimera will not soon attain reality.

We have now exceeded the general notice of Mr. Helps's address that it was intended to give. But it cannot be left without saying that we do not think he has dealt altogether justly by the Settle-Padfield retort in not mentioning the character of the slack carbonized in it, and comparing the production of that particular coal with the yield in ordinary working. The large expected saving in labour expenses surely deserved a word. Before, too, referring to the Motherwell arrangement of charging gas-producers, it would have been fairer on the part of the President—as he does not appear to be altogether confident on the point—to have confirmed his impression before casting doubt on the soundness of the patent of a promising system. He may be recommended to read certain applicable passages in Mr. Fletcher Moulton's recent address on "Inventors and Invention."

There were two other matters which specially engaged the attention of the Midland members—the one is that of affiliation referred to elsewhere, and the other a paper on "Gas-Fires," by Mr. Sidney O. Stephenson. Neither the paper nor the discussion was very favourable towards those articles of frequently impeached virtue; but whether gas-fire makers will profit from Thursday's proceedings time alone can disclose.

The Manchester Institution Meeting—Criticisms of Manchester Retort-House Practice.

Although readers may find somewhat overwhelming the amount of material proffered them this week as the outcome of two District Association meetings, complaint cannot be made that it is dull or uninteresting. Indeed, in one part of the Manchester Institution meeting, the proceedings will be found to be of a particularly animated character. But that fact must not divert attention from the eminently practical address with which Mr. H. Townsend, of Wakefield, inaugurated his year of office. The greater part of his deliverance was devoted to matters outside the gas-works gates, although internal affairs which have been receiving the particular consideration of the President were brought into prominence in the latter part. Above all things, Mr. Townsend has been distinguished for his diplomatic and militant policy in developing the sale of gas; and therefore, while they cannot be noticed here in detail, the experiences and prudent advice that he gives in this direction deserve respectful regard. Unlike the President of the Midland Association, Mr. Townsend finds it pays to make a generous bid for business beyond his mains.

Very little information has leaked out during recent months as to the success or otherwise of the new commercial branch of the Institution; and to gain a knowledge of the precise condition of affairs in this respect, a few sentences in the President's address and a paragraph in the Committee's annual report must be read together. It is regrettable to learn that the establishment of the commercial sections has only been partly successful; but where it has been successful the results are of a very gratifying order. The Blackburn and Stoke sections have failed to raise themselves to a self-supporting position, for reasons which were clearly stated on the consideration of the annual report. On the other hand, the President informs us in his address that the Manchester branch now numbers 34 members, while the Yorkshire section has a roll of 37 members; and very beneficial effects are accruing from their efforts and conferences. The number of members in these two sections is very encouraging; seeing that it represents about half of the ordinary membership of the Institution.

Taken all through, the address scintillates with suggestion, not only in regard to the outdoor department of a gas manager's work, but in connection with several other problems that the occurrences of the times have brought before us. The President advocates a radical change in Private Bill procedure, in view of the glorious uncertainty in which, under present conditions, applications to Parliament are now submerged. His plan for improvement (which is not by any means a new one) is that Private Bills should be submitted to a combined Committee of both Houses. He also imparts some useful hints on the regulation of labour in gas-works and on insurance; and in connection with the new forms of retort machinery, he offers a suggestion which we do not remember to have seen advanced before, that the work of the new rams would perhaps be facilitated if the retorts were set at a slight angle—say, 2° or 3°.

Beyond the President's address, there were two papers down for discussion, by respectively Mr. J. G. Newbigging, of Manchester, and Mr. H. Kendrick, of Stretford. Both contributions were on subjects that have been prolific of much oratory and composition of a more or less persuasive character—generally less. Mr. Newbigging's contribution was on "Horizontal *v.* Inclined Retort Installations, with "Notes on Coke Conveying," and Mr. Kendrick's on "Car-"buretted Water-Gas Workings." On this occasion, the effect was tried of circulating the papers well in advance of the meeting, and taking them as read. If the result of this previous circulation is going to be that one or two members are coming to the meetings so well prepared for discussion that they will be able to monopolize the whole of the available time, then this method of proceeding may not be regarded by other members who have something to say as an unmixed blessing. This is not said with any disrespect to Mr. J. C. Belton and Mr. T. Duxbury, who found so much matter for criticism in Mr. Newbigging's paper that they succeeded between them in taking up, within a few minutes, the whole of the time at disposal for discussion on Saturday. Several other members were known to be prepared for a share in the debate; and, as a consequence, the discussion has had to be postponed to a future meeting. It is not likely to be resumed at the excursion meeting; so that it may be expected that several months will pass before the papers are disposed of. The case of the District Gas Associations is not that of the large central Institutions in London, whose frequent meetings permit discussions to be postponed without harm—perhaps often with benefit; but the same thing cannot be done without detriment or a falling-off of interest where members only met at prolonged intervals. Now is not the time, the discussion being incomplete, to comment on the papers or the pungent criticism, by Mr. Belton and Mr. Duxbury, of Manchester retort-house practices and preferences; but beyond the membership of the Manchester Institution there will be curiosity as to the answer Mr. Newbigging will have to make to his unsparing critics.

The Lords and the Metric System.

When the House of Lords is not occupied with saving the nation, or following the Gilbertian ideal of "doing nothing "in particular, and doing it very well," their Lordships are apt to find time hanging heavily on their noble hands. It

must have been in such an interlude of serious duty that the Lords, last Tuesday, read a second time and referred to a Select Committee, a Bill to make the use of the metric system of weights and measures compulsory in the United Kingdom within (say) two years. There is something quite Shakespearian in the humour of this proceeding, breaking in as it does upon the current of such passing events as we who now live are permitted to see. Does any technical reader of these lines, we may wonder, think seriously that within a couple of years the index of every gas-meter in the land may have to be changed, and a system of charging for gas, coke, and residuals, and purchasing coal and oil, with which he has been familiar from his childhood, given up in favour of a substituted system which very few people in the country know or care anything about? Yet this is the pleasant little surprise the House of Lords has prepared for the gas industry, at the instigation of Lord Belhaven. The debate which greeted the introduction of the subject is interesting reading, especially as it ignored the real and insuperable objection to the change—namely, that the people do not want it. Lord Wolverton, speaking for the Government, pointed out that the construction clauses of the Bill might lead to curious results, especially in regard to "rail-"way rates, sales of land, the price of gas, and legislation "relating to the gallon."

The truth is, of course, that scientific persons like Lord Kelvin, who gave his blessing to the Bill, are not the people whose interests are affected in these metric system proposals. They can count and reckon in any system with equal facility. But it has never been shown why the gas industry, for example, should be put to the expense of changing all the meter indices for no conceivable advantage either to the industry or to the public. If all the business of the country were to start anew, it would be open to be argued that the metric system should be adopted as the basis of measurement. As it is, the cost of changing the system would be something of which noble lords have no conception. It is the same with the British currency. Why does nobody venture to propose the compulsory retirement of the sovereign in favour of the franc? In theory, almost all the advantages adduced on behalf of the metric system of weights and measures attach equally to the decimal system of coinage as adopted by the Latin Union. At one time, indeed, the two questions were always placed upon the same basis of science and logic, and argued together. Experience, however, has been too much for the opponents of the sovereign, shilling, and penny; and it is just as strong against the metre, the litre, and the kilogramme. These artificial weights and measures have had their chance in the open. It has been left for the people to choose; and still, after almost a century, they prefer, like Rankine's working man, to "eat by the pound, and drink by the pint, and "work by the three-foot rule." The case for the voluntary adoption of the metric system by any English-speaking people seems to be hopeless; and the compulsory imposition upon the British Empire of a system of weights and measures which has never made the smallest approach to popularity outside chemical laboratories, is beyond the scope of practical politics.

The Discounts of the Gaslight and Coke Company.

It was to be expected that the decision of the Directors of the Gaslight and Coke Company to grant discounts to large consumers and to users of gas for power purposes north of the Thames, would lead to some question as to their own payments by the Local Authorities interested. Accordingly, it is not surprising to learn, as reported elsewhere, that the matter has been considered by the Corporation of London, who have decided that they ought to have the discount in respect of all gas supplied for public purposes to the City. This is their legitimate business. The Directors have announced that they cannot make any allowance of the kind on gas supplied south of the Thames, nor as regards public lighting accounts to the Local Authorities on the north side; the reason being, of course, that the Company already do this part of their business at a loss, which has to be borne by the other consumers. This is a consequence of the operation of section 39 of the Scheme of Amalgamation with the London Company in 1883, which requires that the Company shall not charge in the district of South London formerly supplied by the London Company, a higher price per 1000 cubic feet of 16-candle gas than that for the time being charged by the South Metropolitan Gas Company for gas of the same illuminating power; and section 86 of the City of London Gas Act, 1868, was also made to apply, as against the United Company, to the whole of the public lamps supplied with gas of similar quality, but not to the private consumers, within their district north of the Thames. This clause requires that the Company shall not charge a higher price for gas supplied (to the Commissioners of Sewers, who were at the period the public lighting authority for the City) than the lowest price per 1000 cubic feet charged by them at the same time to any private consumer. But if the Company contend that there are special circumstances justifying them in charging a lower price to any other, the question should be referred to arbitration, and the price thus ascertained should be in force for two years.

As a matter of fact, the Gaslight and Coke Company charge less under this provision than they are strictly entitled to, inasmuch as the South Metropolitan price, which is the datum, does not include any meter-rent, whereas the former Company do not charge these rents in any part of their large district. With regard to discounts, moreover, the South Metropolitan Company also allow them; so that the Gaslight and Coke Company are really only following their example in this respect. It might, perhaps, be argued as a point of law, whether the price of gas intended in this very common provision for the benefit of the local authority in regard to their public lighting accounts, means the net payment actually received by the Company, or the regular price charged, but subject to discounts for special accounts. We incline to the opinion, for what it may be worth, that the price of gas in the legal sense is the "price charged," as the Acts put it, irrespective of discount. In some cases, as a matter of policy, the local authority are allowed the same discount as the most favoured consumers, for the same considerations of prompt payment and large aggregate consumption for lighting. Clearly, where special discount is allowed on accounts for gas consumed for cooking, heating, or any industrial purpose, it does not apply to gas supplied to the public lamps. The question as it is now raised is whether the obligation referred to applies to the price charged or to the payment actually accepted. For all other purposes, and notably for the working of the sliding-scale, discounts are not regarded. Gas companies would not be permitted to divide extra profits up to the percentage computed from the lowest rate of payment for gas received; and it might therefore be inferred that, for general purposes of the interpretation of their Acts, the term "price of gas "charged" means the regular price in force, irrespective of any allowances having a particular and conditional application. Acts of Parliament must be strictly construed in this regard, because the principle of uniform charges is not recognized by common law.

Recent Nuisance Cases and their Lesson.

The attention of gas manufacturers throughout the United Kingdom should be given to the nuisance litigation in which certain suppliers of electricity for lighting purposes have lately been involved, to their misfortune. One was the Ryde case, in which the installation of a producer-gas generating plant was successfully opposed by a resident. Here the Court decided against the installation on the ground that it was not a proper use of the site, having regard to the character of the neighbourhood. The second case was on vibration; the defendants being the St. Pancras Borough Council. Vibration is a nuisance closely analogous to that of offensive fumes, inasmuch as it is a matter on which opinions can differ widely. The difficulty of establishing the fact is often aggravated by the circumstance that the amount of the annoyance may vary from hour to hour, and distribute itself in a perplexing fashion. In the case in point, however, the Court found that the nuisance existed in fact; and that it was serious, and not of a temporary character, and not covered by the Provisional Order under which the work was carried on. There was the usual clause in the Order making the undertakers liable for any nuisance they might cause. The Court held that the true meaning of this statutory provision is that the works must not be carried on at all, unless and until this can be done without occasioning a nuisance to their neighbours. It had been contended for the defendants that a public body doing its best to discharge a statutory duty with reasonable skill, is entitled to a certain amount of grace, so as to find out how to do it with

the smallest possible nuisance to the public. This was the proposition which the Judge refused to accept. However, as an act of grace, he suspended the operation of the injunction for six months, on conditions. Then a few days ago, the owner and occupier of property in the immediate vicinity of the works of the Natural Gas-Fields of England obtained an injunction against the Company for creating a nuisance which interfered with his health and compelled him to remove. The bearing of these judgments on gas manufacture is perfectly plain. The question of nuisance is, in the first place, governed by the character of the locality. It does not require any particular covenants to protect the owners and residents of property in one class of district from damage inflicted by another freeholder who shall elect to put his land to an unsuitable use. Again, the plea of having a statutory duty to perform will not absolve an undertaker from liability for creating a nuisance, if he can possibly carry on the work inoffensively. Thus, it by no means follows that a gas-works hitherto carried on unobjectionably, having regard to the nature of the work—that is to say, with a certain modicum of smoke and fume—would be held blameless if another process to which more exception might be taken were later on adopted, merely on grounds of commercial expediency. These are matters that occasion reflection, which may as well be in advance as after the mischief has been done.

The Marylebone Muddle in Parliament.

THE troubles of the Marylebone Borough Council in connection with their unhappy plunge into municipal trading, are of a kind that do not deserve, and certainly are not receiving, the smallest pity. We observe that Mr. D. Ford Goddard, who has been almost superfluously self-effacing as a Member of Parliament with special knowledge of the lighting industries, has had an eye to the future of Marylebone, and has given notice of his intention to ask the House to protect the ratepayers in the event of the Council's electricity-supply scheme going forward. It has likewise transpired that the Gaslight and Coke Company intend to oppose the Council's Bill; but on what grounds does not, of course, appear. This long-suffering Gas Company, at any rate, have ample reason for resisting any further addition to the outrages inflicted upon them, both in the way of their business and also as ratepayers, by the electricity-supplying Local Authorities of Northern London. Seething the kid in its mother's milk is as nothing to making a gas company pay in rates for the running of an electric light undertaking in unfair competition with itself. It is high time the real nature of this outrageous performance was published; for one cannot believe that Parliament, in bestowing upon local authorities the favours granted to such bodies by the Electric Lighting Acts, ever had the slightest suspicion of the way and extent to which these advantages would be abused. It has been left to electric lighting law to signalize and complete the difference between a municipal body and the general body of ratepayers which had begun to be perceived in earlier concerns. In the case of Marylebone, the separation is so complete, that on Friday last Mr. Justice Buckley, sitting in the Chancery Division, said he wished it was in his power judicially to discriminate between the ratepayers and the Borough Council. This is what local "self" government has come to! The legal representatives of the ratepayers have plunged the community into obligations which it would take a 20s. rate to meet; and after that there would still be a continuing responsibility for the ratepayers to bear. All this has been brought about by the action of a coterie of local busybodies elected for three years by a system which completely failed to acquaint the ratepayers with what they might expect. As the Judge said, the Council should have sat down and considered the matter before they began to think of getting statutory powers; but it is notorious that, instead, they were led astray by a handful of ignorant and presumptuous persons who had fallen into the common weakness of thinking and speaking evil of a statutory supply company which was doing its duty. Some remedy for this mischief ought to be diligently sought and applied, for the prevention of similar scandals in future.

The Acetylene Association

There is not the slightest doubt that the progress of the acetylene industry has been very greatly retarded by the dangerous character which has become attached to carbide of calcium. Regulations have been drawn up and restrictions imposed which have greatly hampered those interested in this form of illumination; and consequently strong efforts are being made to secure their modification. That great care is required in the manipulation of both material and plant, has been amply demonstrated by the serious accidents which have occurred; but at the same time it is quite evident that the alarm to which these occurrences naturally gave rise has resulted in the infliction of a considerable amount of hardship, more especially on dealers in carbide. The efforts that are being made by the Executive of the Acetylene Association (the proceedings at the third annual meeting of which are recorded elsewhere to-day) to obtain relief in this matter, will therefore be watched with the greatest interest by those who have identified themselves with the introduction of this method of lighting. Much hard work has been done; and there is promise of the attainment of a considerable amount of success. In several directions, however, negotiations have at present not reached a stage at which they can be made public. Important correspondence with the powers that be was read to the meeting; and it is to be regretted that so very few of the members of the Association (the number was something under twenty) were present to hear it. No doubt the Executive will, all in good time, announce the results of their labours; and we trust their statement will be a satisfactory one.

And Its Labours.

Meanwhile, our report of as much of the proceedings at the meeting as we were not requested by the Chairman (Sir Charles S. Forbes, Bart.) to refrain from publishing, will give some idea of the main objects which are being aimed at. Already some progress has been made towards inducing the Railway Companies to relax the rules governing the carriage of carbide; and now an effort is being made to secure a modification of the regulations regarding packing. Then the Local Government Board are being tackled with reference to the granting of loans for installations of acetylene lighting in public buildings. Negotiations are also in progress with the Home Office and the India Office; the former dealing with the hardships which existing regulations as to licences inflict upon all connected with the carbide industry, and the latter with a rule prohibiting the shipment of any official goods by a vessel which also carries carbide of calcium. Other matters which are under consideration are the holding of an exhibition of acetylene appliances, and the issue of a popular pamphlet dealing with the advantages of this light. It will thus be seen that the Council of the Association are actively engaged in promoting the interests of the industry which they represent; and it is to be hoped that when the next meeting comes round a larger number of members than on the present occasion will be able to make it convenient to attend. No doubt by that time some very important developments will have taken place; and a large attendance will be the most fitting way of showing appreciation of the arduous work undertaken by the Executive and the indefatigable Secretary (Mr. Lacey Downes).

A Junior Gas Association

In Mr. F. Ainsworth, of the Ilford Gas Company, the London and Southern District Junior Gas Association at their last meeting found an able exponent of the every-day problems by which managers and their assistants are confronted. At Ilford, there is a municipal electric light undertaking, which has succeeded in bringing out all the fighting capacity of the Gas Company; and the author of the paper showed how well able his Company are to take advantage of the powerful weapons that inventive genius has placed at hand for the purpose. His communication was an eminently practical one; and the points touched upon were so varied, and of such universal interest, that most of the members present were able to speak on one or more of them. The result was a discussion which cannot fail to have been extremely gratifying to Mr. Ainsworth, as well as of great practical benefit to the Association. The competition of electricity with gas, keen already in many places, will grow keener still as time goes on; and the rising generation of gas managers cannot study too much the means that may be adopted for successfully combating it. As far as lighting is concerned, the various applications of the incandescent system are, of course, invaluable to this end; while for heating and power purposes gas has an enormous field open to it. How much is already being done towards popularizing the

use of gas-engines was shown by some extremely interesting statistics adduced by Mr. Liberty, which will be found in our report of the proceedings. Yet there can be no doubt that at present little more than the fringe has been touched of this important part of a gas company's business.

And the Adoption of the Question-Box.

A new feature in connection with this Association, which was announced by the President (Mr. Walter Grafton), is the adoption of the "Question-Box," which forms so prominent a feature of the proceedings of some of the Societies on the other side of the Atlantic. The idea is for any member who finds himself confronted with a difficulty to frame a question on the subject and send it on to the Secretary, who will in turn submit it to the other members. In this way, an answer will doubtless be forthcoming which it may be taken for granted will be of assistance to others besides the member who originally propounded the question. We cannot help thinking that this is a step in the right direction, and shall therefore watch with considerable interest its development. Even among the Senior Associations, difficulty is at times experienced in obtaining papers for reading at the meetings; and this trouble is, of course, much more likely to be manifested among the younger members of the profession, many of whom may not have had the opportunity of acquiring experience or special knowledge of sufficient importance for them to care to bring it before their fellow members in the shape of a formal paper. This, however, cannot apply to doubts and difficulties. Everyone meets with these in the course of his daily work; and by making them known to the Secretary of the Association in the manner suggested, all the members will be able to do something to add to the interest of the meetings. A simple question may easily be the means of raising a valuable discussion, for the Association has already shown itself to be by no means weak in the element of debate.

The Retort Discourteous

It is somewhat difficult to follow the train of thought of the Mayor of Maidstone, who in the course of a letter expresses surprise at the "seeming anxiety" of the Chairman of the Gas Company for the pocket of the ratepayer, and states that this is quite a "new feature" of the Company. One would have thought —seeing that the Gas Company in the town, as in every other, are large ratepayers—that the anxiety would have been very real, and not at all a new feature. But apparently this Mayor is possessed of the prevalent notion that gas companies have no right whatever to raise their voice with regard to the disposal of their money. It was only a few days ago that another company were termed "impertinent" for venturing to oppose the adoption by their local council of a course that seemed likely to add to the rates to which they would have to contribute; and, of course, both cases had their origin in the same thing—municipal speculation in electricity. At Watford, there may have been some little excuse for a feeling of soreness on the part of the councillors, in view of the circumstances which were noticed last week; but the Mayor of Maidstone had no shadow of reason for his exhibition of "polite letter-writing." The communication of the Chairman of the Gas Company which gave rise to it was merely a calm and dispassionate correction of some errors contained in a report of the Highways Committee on the relative cost of electric and gas street lighting in the town, and as such it was fully entitled to that respect and careful consideration at the hands of the authorities which it is to be sincerely hoped it will receive from the ratepayers generally.

And Some Curious Figures.

A short time ago, the Wakefield Electrical Engineer sought to prove that there electricity for street lighting was half the cost of gas; and this seemed (in view of the general experience) to be a fairly bold proposition. The Maidstone Highways Committee, however, have knocked him clean out of the field, for they put the cost of electricity for lighting the tramway route at 5·8d. per candle power per annum, and that of gas at 17d.—or practically three times as much. They do not show exactly how the first-named figure is arrived at, which is perhaps as well, bearing in mind the present financial position of the undertaking; but the cost of gas has apparently been arrived at by the simple process of halving the actual candle power of the lamps, and adding a few pounds to the amount paid for it. This is not all, however; for the Chairman of the Company points out that, on their present contract prices for public lamps, the Company can supply, and are willing to supply, the proposed lighting for the tramway route, equal to the Highways Committee's estimate of candle power, at a saving of something like 30 per cent. per annum on the price they quote. If, after this statement of the facts of the case has been placed before them, the majority of the ratepayers are willing to support their electric light undertaking at the expense of their pockets, there is no more to be said. They must merely possess their souls in patience pending the time (which the Mayor says will be "very shortly") when the Council will be receiving a profit from the Electricity Department towards the reduction of the rates, and the charge for public lighting will be lowered—meanwhile paying a larger sum for an inferior system of illumination. The Gas Company will doubtless survive the blow, seeing that their present charge for incandescent street lamps is £2 19s. per annum of 3650 hours, inclusive of all charges, and that last half year, in spite of the competition of the electric light, their output showed an increase of nearly 7 per cent. We are therefore not particularly concerned for them; but the controversy is interesting as showing some of the methods that are adopted for pushing municipal electricity.

WATER AFFAIRS.

The Metropolitan Water Arbitration.

THE Arbitrators under the Metropolis Water Act, 1902, virtually brought their labours to a close on Friday, when they made their award in the claim of the Water Board against the Corporation of Croydon for compensation for the portion of the works of the Lambeth Company which is to pass into their hands, and adjourned *sine die*. Though there were only three sittings last week, the proceedings were of considerable importance. On Monday, as already reported, four further awards were made, leaving only the claim of the New River Company to be adjudicated upon. The settlement of this matter will depend upon the judgment of the Court of Appeal, which is put down in the list for delivery to-morrow, on the points of law recently argued before that tribunal. The Companies' claims would have been practically disposed of had not an error been detected in the case of the Chelsea Company, the correction of which added £700 to the amount awarded on the assumption that the Court were right in respect of the dividends. The cases of Richmond and Croydon were next in order for consideration; but as an agreement had been come to in respect of the former place, the Arbitrators turned their attention to the latter. The Water Board claimed in respect of the works and plant, and as compensation for the loss of the business, actual and prospective, connected therewith, the sum of £255,000. The Corporation offered £190,000, subject to the condition that they should be assured a supply in perpetuity of 500 million gallons of water per annum, for which they offered to pay at the rate of 1·6d. per 1000 gallons—the cost of production. Sir Alexander Binnie saw no reason why this quantity should not be continued; but he said the Water Board wished to have a revision of the price after ten years, so that the charge to the Corporation should be the cost to the Board. These were the points dealt with by Counsel. Mr. Fitzgerald, for the Board, offered to accept 2d. per 1000 gallons, with revision; while Mr. Ram expressed the willingness of the Corporation to pay this amount, but without revision. In the result, the Arbitrators awarded £225,810; the price for 30 years from the 24th of June next to be 2⅛d. per 1000 gallons, and then to be subject to revision at each succeeding period of ten years.

The announcement of the awards in the Companies' cases was followed by a sharp rise in the stocks of several of them; so that the terms granted cannot be regarded as particularly bad, though they are not so good as those offered in 1880, which, if the transfer had then been effected, would have resulted in a considerable loss to the ratepayers. On Aug. 30, 1879, the market value of the undertakings was £18,600,000. and the new stock offered for them amounted to about £29,700,000. Between that date and the end of

1901, the value had gone up to £21,773,000; while in the interval which has since elapsed the figures have risen to £23,893,000. Curiously enough, one of the two undertakings for which the Board declined to make any offer—that of the Southwark and Vauxhall Water Company—has increased in value to a greater extent than any of the others; the figures being £2,751,000 and £3,491,340, or a difference of nearly £750,000. The awards at present made amount to £24,695,000, against about £35,000,000 claimed. If the Companies succeed on the question of the sinking fund, £1,300,000 will have to be added to the awards; and there will be the New River award—which will probably bring up the total to something like £33,000,000, exclusive of debenture stocks, which will raise it £10,000,000.

Now that we are able to make an approximate estimate of the cost of the water undertakings, it may fairly be questioned whether their purchase will be profitable at the price. A few years ago, the market value of the Companies' stocks, including debentures, was estimated by a competent statistician at close upon £40,000,000; and it was thought that this was the minimum sum that could be offered for them. Assuming that the purchase-money could be raised at £2 12s. per cent., and repayment of the principal spread over eighty years, it was reckoned that an annual income of nearly £1,190,000 would be required for the interest and sinking fund. As the average net yearly income of the Companies for the seven years prior to the date of that calculation was £1,150,000, the purchaser stood to lose every year £40,000. Of course, the past five years' average would be a higher figure; and this would reduce the deficit. But supposing it should only be one-fourth of the amount named, it will not be a welcome addition either to the consumers' or the ratepayers' burdens, especially in view of the promise held out that the latter would in all probability be lightened as the outcome of the purchase. However, the municipalization of the water undertakings has been agitated for, more or less strenuously, during the past thirty years, as being absolutely necessary for the well-being of the Metropolis, and for bringing it into line with the "progres-" sive Provincial Local Authorities;" and if the operation should eventually prove to be a more costly one than was anticipated, those who have to bear the expense will have the gratification of knowing that they have got rid of the "obnoxious Water Companies." Whether they will fare better at the hands of the new authority remains to be seen.

Death of Mr. A. H. Cane, of Reading.—We regret to announce the death, yesterday morning, as the result of a paralytic seizure on Sunday, accompanied by cerebral hæmorrhage, of Mr. Arthur H. Cane, F.I.S., F.S.A.A., the Secretary of the Reading Gas Company—a position he had held for about thirteen years. Soon after the formation of the Institution of Secretaries, Mr. Cane was chosen for the presidency.

Mr. Charles Meiklejohn has been ordered by his Doctor to take a health trip; and he leaves to-day, with the heartiest good wishes of the Directors of the Rugby Gas Company and those of his friends who knew of his departure, for a six weeks' cruise in the Mediterranean. He is being accompanied by Mrs. Meiklejohn. For a year or more, his health has not been quite up to its usual standard; and it is hoped that the long rest and change will do the needful work in raising it again to at least its normal level.

The Coal Tests in the Settle-Padfield Experimental Retort.—The article which appeared in the "JOURNAL" for Jan. 12 on the Settle-Padfield system was accompanied by a tabulated statement of the results of tests of various classes of slacks. In three instances slacks were referred to under the designation of South Pelton; but in one case "Pelton" was mentioned. It is understood that this should also have been described in the original table and in our reproduction as South Pelton; the Owners of Pelton Colliery, Limited, assuring us that no original Pelton Main coals have been supplied for these tests.

Gas v. Electricity for Shop Lighting.—In reply to a question put by some correspondents of the "Ironmonger" on this subject, another correspondent has supplied the following figures: "A No. 2 Kern gas-burner of 50-candle power consumes only 2½ cubic feet of gas per hour, or 125 feet in 50 hours, the cost of which (at the price in Leeds of 2s. 3d. per 1000 cubic feet) works out at about 3½d. A 50-candle power incandescent electric bulb accounts for 3½ watts per candle power per hour. This, in 50 hours, equals 8750 watts, or 8¾ units, of electricity, and the cost (again calculated at the price of electric light in Leeds, of 4d. per unit) equals 2s. 11d., or ten times the price of gas." Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, has also replied, and pointed to the banishment of the electric light from Victoria Station, and the substitution of the incandescent gas system, as recorded last week (p. 465).

THE PUBLIC LIGHTS OF LONDON.

(*Concluded from p.* 463.)

IT was a remarkable statement with which the third article of this series ended. It disclosed some facts that even those most interested in gas lighting in London could not have been entirely aware of, and that municipalities smitten with the electrical fever should absorb as an antidote. It may be confessed that, in commencing this record, we had not dared to hope, much less to imagine, that improvement in the lighting of the thoroughfares of London had been so largely in favour of incandescent gas lighting. It is a powerful testimony to the recognition of its economy and efficiency by Local Authorities. In a provincial city or town, the lighting is under the domination of one authority; and the favour of the majority rules and commits the community to the character of its street lighting. Here we have consolidated the views and opinions of no less than 29 City and Borough Councils, with the result that (as has been shown), out of a total of 81,097 lamps in the Metropolis, only 6159 are fed by electricity; and the remaining 74,938 are supplied by gas. Of these, including 4890 which are being (or are about to be) fitted with incandescent burners, 56,690 are on the incandescent gas system; while 18,248 are still unprofitably burning gas on the old flat-flame system. Nearly, if not all of these, it may be assumed, are situated in side streets, and that therefore the time is not far distant when they too will be raised to the dignified standing as illuminating centres of the 56,690 that have preceded them.

When we come to analyze the figures as to electric lighting, the amount of its adoption assumes an even more insignificant aspect. Of the 29 Councils, 19 only have gone in for electric lighting; and three of them can only total 17 lamps between them. This leaves 16 authorities; and of these fifteen vary in their arc lighting between as low as 77 lamps and only as high as 507. The other one the City of Westminster possess 1141 electric lamps, which number includes the famous folly of the defunct Vestry of St. George's. Eight of the same authorities have gone in for incandescent electric lighting; but to only a comparatively small extent. In but three cases do the number of columns bearing electric incandescents exceed 100; the figures for the other three are 165, 240, and 502. Electric incandescent lighting is going altogether out of fashion—if ever it came in; and electric arc lighting, it has been shown, cannot, even in the richest districts of the Metropolis, make any extraordinary headway. It has taken years upon years for it to reach its present small proportion. Its initial cost and its annual cost are the two main factors that have operated against its progress; and now the Authorities, judging by the City Corporation, are awakening to the fact that its want of efficiency under all atmospherical conditions, and its congenital defects, are things that, in the interests of the communities, cannot be longer ignored, let alone tolerated to an increased degree.

The validity of the figures given in the course of these articles cannot be questioned. Care has been taken that there shall not be room for that. Conjecture or estimation has had no part in the compilation. In every case (this it is desired shall be kept well in mind), the statistics have been supplied direct by the officials of the Councils. There are but few additional comments to be made on the figures. It will have been observed that the charges for electric arc lamps vary considerably in different localities. This is doubtless accounted for to some extent by the differences in lighting values; but, if the districts are attentively studied, it will be noticed that in those districts where the electricity undertaking is in the hands of the Local Authorities, there, as a rule, will be found generously low charges for street electric lighting. There, too, save in the two cities, is to be found the greatest use of electric lighting for public purposes; but even then it is not of considerable amount. The incandescent electric lights are found to be extravagantly dear in comparison with incandescent gas lighting—taking light for light. Look at Poplar, for example, with its 24-candle power incandescent lights costing £5 6s. 9d., and its 64-candle ones costing £14 4s. 8d. With incandescent gas lighting, including maintenance, the light of the latter can be obtained at a cost somewhere between 50s. and 60s. per annum, including everything.

There are, however, still 18,248 flat-flame gas-lamps to be attacked. It cannot be said that it is the fault of the Gas Companies that these are still in existence; it is, indeed, due to them to say that the greater part of the 56,690 flat-flames that have been converted have fallen to their own arrows. While these 18,248 lamps remain, the Companies must not—it may be depended that they will not—relax their efforts. Those lamps will be the subjects of their attentions from time to time. It is a marvellous thing that the Authorities owning these relics (they are only to be found in fourteen of the boroughs) should hesitate at all in having them converted, in view of the large increase in illuminating power that can be obtained at about, in some instances at less than, present expenditure. And there are some fairly important positions too that come to mind where the antiquated method still holds sway. The Chelsea and Albert Embankments are cases in point; and yet for the lighting of these the London County Council, who vote away money in hundreds of thousands upon other sometimes good but ofttimes doubtful improvements, are responsible.

The figures which we have given show what a tremendous

change has come over the face of London at night time in respect of its illumination. It has been pointed out that, in large measure, the honour for this is due to the Gas Companies. But they have gained and lost by their action; and this the public overlook. As purveyors of a commodity, they have obtained a good advertisement; as large ratepayers they have gained something in preventing, or showing that there is no necessity for, a large prodigal expenditure on expensive electric lighting. For them, too, is the gratification of knowing that they have, by what they have done, rendered (without, in most cases, increased expenditure per lamp) the streets brighter and safer between sunset and sunrise. But they have lost largely in the sales of gas through the adoption of incandescent burners in the streets, and not through the adoption of electricity, excepting in so far as the lamps displaced by the electric lights would have meant increased business. This is said on the strength of the Board of Trade returns. We will take five Gas Companies supplying within the Metropolis—some of their districts extend beyond, which will account for the figures disagreeing somewhat with those already quoted. These Companies are the Commercial, the Crystal Palace District, the Gaslight and Coke, the South Metropolitan, and the Wandsworth and Putney. Now the Board of Trade returns show that in 1892 the Companies were, all told, supplying 79,402 lamps, which consumed 1,649,087,000 cubic feet of gas in the year. In 1902, the Companies had (taking the total) 1315 more lamps; but notwithstanding this, the consumption of gas for public lighting then had fallen to 1,555,207,500 cubic feet. There is a loss of consumption on the public lighting alone, between the figures of 1892 and 1902, of 93,879,500 cubic feet; and this with the 1315 more lamps. The loss last year with the continued growth of incandescent lighting may have been considerably more than that. Yet the Companies are ready and anxious to complete the conversion of the flat-flame lamps to the only system on which gas can be economically used to the greatest advantage.

There is a lesson here for those gas companies in the Provinces who have not yet paid much attention to this question of improvement in public lighting—not even, and there are such, in defence of their own interests. As recently as 1899, flat-flame lighting was predominant in London; the major part of what we have shown has been done in incandescent street lighting has been the work of the years since then. It is a lesson on the advantage of having something to offer the local authorities; and in nearly all cases the incandescent system has within it a margin upon which gas companies can work. If the Gas Companies of London had not offered the Local Authorities something that was obviously worth having and easy to get, the years might have been doubled or trebled before the Companies would have had the showing in incandescent lighting in the streets that they have to-day. The plan which the South Metropolitan Gas Company offered to the Local Authorities and which was so quickly successful, was (to put it generally) to apply the incandescent system to the whole of the lamps in the parishes, and to make use of the saving resulting from the reduced consumption of gas in improving and renewing the lanterns—bearing labour charges themselves. They found the money for the work; and the Authorities continued, and are continuing, to pay the old charges for flat-flame lighting until the expense was, or is, cleared off by the difference in the money values of the gas consumption. It is not part of the scheme of this article to criticize; its whole intention is to inform. But it must be pointed out that, under the South Metropolitan Company's system, the Local Authorities appear to have eagerly taken advantage of the largest difference in cost shown as between the old and the new systems of lighting, by very extensively adopting the No. 2 incandescent burner consuming only 2½ cubic feet of gas per hour. The improvement in the lighting of the streets even by these was great in comparison with the old order of things, but the improvement visibly falls short of that obtained by even No. 3 burners. On the north side of the Thames, the general rule is for incandescent burners consuming from 3½ to 4½ cubic feet; and the increased value realized in illumination is well worth the extra consumption. Then the Gaslight and Coke Company, after the South Metropolitan Company's great success, put forward a plan which, if the Company have not always succeeded in getting the contracts for converting the lamps, has helped, and that largely, to put life into the dry bones of the old-time parochial indifference in this matter of lighting. The scheme offered by the Company, and which they have carried out in several instances, has been (without going into detail) to execute the whole of the work of conversion for the Authorities at the Company's own initial cost; the Authorities repaying the Company by quarterly instalments, spread over five years, *without charging them any interest on the money so spent*. So that the cost of lighting under the new system and the cost of conversion have with the Gaslight Company been kept quite distinct. Islington, Hackney, Stoke Newington, Finsbury, and Hampstead, and part of Lambeth and West Ham are among the successes of this plan. The lighting of St. Margaret's, Westminster, was also carried out under contract by the Company; but the contract expires, as already noted, this year. One of the most satisfactory features about this change in the gas lighting north of the Thames is that important boroughs—such as Hackney and Islington—possessing electricity works of their own have gone in so extensively for the incandescent gas system, as our notes applying to those boroughs have disclosed. The removal of the cost difficulty in the way of public lighting improvement is shown by the experience of London, through one of the two "easy-payment" systems, to be an effectual method of retaining the public lighting, and of keeping at bay, at the same time, the seductive and expensive electric arc lamp.

In the course of these articles, in addition to the revelation as to the immense progress of the incandescent gas system, the figures have been given as to the charges, including maintenance, paid for the lights by each borough. We cannot usefully touch upon those payments further, as so many circumstances affect them—particularly the variations in the sizes and consumptions of the burners, and the duration of lighting. A great deal of information, however, is to be obtained by studying the figures of the districts individually.

In Berlin and Paris.

There is one other interesting matter to be dealt with. Is the experience of London in the matter of this vast adoption of incandescent gas-burners that of other capital cities? We say unhesitatingly that it is. To supplement our articles, and to show how universal is becoming the incandescent gas-light for public purposes, M. Lauriol, the Chief Engineer of the Public Lighting Office of the Municipality of Paris, and the Chief of the "Direktion" of Public Lighting in Berlin, have forwarded the statistics referring to those cities on comparable lines to those which have been published in these articles for London.

We will take the figures from Berlin first, as the lighting of that city has been so frequently the subject of allusion in writings and discussions on public lighting questions. The area of Berlin, our courteous correspondent informs us, is 15,235·3 acres. In all there are in the city streets 23,903 lamps; and of these only 576 are electric arc lamps and 112 electric incandescents. The incandescent gas lighting is of a diversified character; and what is more (the same it will presently be seen is true of Paris) high-power and cluster lighting is far more prevalent there than it is in London. Here in Berlin we find there are a total of 23,215 incandescent gas-lamps, of which 117 are high-power, fitted with two burners, and 31 similar lamps each supplied with only one burner. Cluster lighting bulks very largely; there being 6071 lamps with two burners, 239 with three burners, and 8 with five burners. There are also 16,749 lamps fitted with single burners. To the inquiry as to the number of flat-flame burners, the reply is "*nicht vorhanden*," which in plain English means there are none. Regarding costs. The average cost of the arc lamps per annum is 424·92 marks, which (taking the mark at the approximate exchange of 20 marks to the pound) represent £21 4s. 11d.; the average cost of the electric incandescent lamps is 76·98 marks, representing £3 16s. 11⅜d.; while the average cost of the incandescent gas-lamps per burner (including maintenance) is 59·70 marks, or £2 19s. 8d.—the average consumption of gas being 18,435 cubic feet per annum.

M. Lauriol has placed us under great obligation for his highly interesting communication on the lighting of Paris. Here we are dealing with a city of 3·02 square miles; and within its streets are to-day to be found 1719 electric arc lamps, only 100 incandescent electric lamps, 49,294 incandescent gas-lamps, and 2552 flat-flame gas-lamps. Intensive incandescent gas lighting here greatly exceeds both London and Berlin; there being no less than 5300 burners, each consuming from 5·3 to 9·5 cubic feet of gas an hour. In 1325 lamps, too, there are grouped clusters of two, three, four, and five burners, with a total consumption of from 7 to 49·4 cubic feet per cluster per hour. Of single incandescent burners, there are 42,669, consuming 3·5 cubic feet of gas an hour. Against this considerable number, there are only 2552 flat-flame lamps, burning from 3·5 cubic feet to 8·5 cubic feet per hour. Taking the whole of the incandescent burners, the average consumption would work out to 4 cubic feet an hour; and similarly averaging the consumption of the flat-flame burners, it comes to 4·16 cubic feet. The average cost of the gas supplied to the incandescent burners is 65 frs. 81 c. (say £2 14s. 10d.), and the average cost for the flat-flame lighting is 66 frs. 37 c. Gas is charged for at the rate of 15 c. per cubic metre, which is equal to 3s. 5d. per 1000 cubic feet. For the lighting, extinguishing, maintaining, and cleaning of the old flat-flame burners 6·5 c. per lamp per day is charged. For the incandescent burners there is an extra charge of 12 frs. per annum for the renewal of mantles, chimneys, additional work in cleaning, &c. The average cost of the electric arcs is 30 c. per lamp-hour, including maintenance, carbons, &c. It must be confessed when the area of Paris within which the large number of lamps is situated to which reference is made is compared with that of London, that the provision for the lighting of our own Metropolis pales before that existing in the great Metropolis across the Channel.

But the chief object of our inquiry has been fulfilled. Whether we look in any one of the three large capitals—London, Berlin, or Paris—the same thing is found, that public electric lighting is a very minor quantity, and that incandescent gas lighting has attained a position of pre-eminence from which it will not be an easy matter to dislodge it. Why should it not occupy that position in every city and town of this kingdom? It has economy and efficiency on its side. London, Berlin, and Paris have very distinctly said so.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 576.)

THE course of movements on the Stock Exchange last week was better than might have been expected. At the opening, it was agitated by the panic which arose on the Paris Bourse the previous Saturday. Consols were marked down to $85\frac{1}{16}$; but before the day was over, things began to mend, and gradually the tendency became fairly firm. Business was very limited; and the settlement (which appears to have given rise to no catastrophe) was the chief item. In the Money Market, there was a good demand for Stock Exchange and other requirements, followed by ease when these were satisfied; and rates for discount lightened considerably before the close. Business in the Gas Market was decidedly quieter, and quite devoid of any striking incident. There was no variation in any single quotation, except the changes arising from quotations being made *ex div.* Of these, however, there were several; and, so far as they could afford any indication, the general tendency was steady. In Gaslight and Coke issues, some moderate business was done daily in the ordinary at about middle prices. Once $86\frac{1}{2}$ was marked; but all other transactions were at or over 87, and several appeared at $87\frac{3}{4}$. A few dealings took place in the secured issues at figures which were not remarkable either way. South Metropolitan opened with some show of activity, but this soon died away; and business for the rest of the week was quiet, but steady. A single transaction in the 4 per cent. was all that was marked in Commercials. Of the Suburban and Provincial group, only one Company (British) was dealt in at all; but a large number are quoted *ex div.* We have before now pointed out extraordinary discrepancies between London and Provincial quotations. This week we note that the quotation of Newcastle and Gateshead ordinary is 95-100 in London; in the Newcastle Exchange, it is 106-108. The Continental Companies were as quiet and humdrum as the rest; and prices for the most part were inclined to show weakness. None of the remoter undertakings were noticeable. The Water Companies were a complete contrast to the Gas Companies; being brisk and buoyant. The favourable decisions delivered by the Arbitration Board on Monday came as a delightful surprise; and Chelsea, Kent, and Lambeth went up at one bound. Many transactions were marked at vastly improved figures, which showed no sign of weakening up to the close.

There were no changes in Gas except on Thursday, all of which appear in the list. In Water, on Monday Chelsea rose $27\frac{1}{2}$, Kent 20, ditto new 5, both Lambeths 15, and Southwark 5; but ditto "D" fell 10. On Tuesday, Lambeth $7\frac{1}{2}$ was put back 5. On Wednesday, Lambeth, both Kents, and Southwark "D" rose 5; but Lambeth $7\frac{1}{2}$ was put back 5. On Thursday, Kent new rose $8\frac{1}{2}$. On Friday, Chelsea rose $2\frac{1}{2}$.

THE SMELL OF IMPERFECTLY-BURNT GAS.

THE observation of a Westmimster Police Court surgeon, recently reported, concerning the supposititious danger to life of bunsen burners that have "lit-back," and are consequently burning gas under improper conditions, suggests some reflections on a branch of gas chemistry which has been very much neglected. Now that so large a proportion of the gas consumed in houses is burnt atmospherically, for the purpose of lighting as well as for heating, it is desirable for gas managers to be well posted in the science of the bunsen burner. This is not by any means an easy study, for the reason chiefly that the various and sundry authoritative statements of those who profess to have investigated the chemistry and physics of the atmospheric gas-burner are scattered over many publications. The most prominent labourers in this field have been the late Mr. Thomas Fletcher, on the practical side, and Professors Smithells and V. B. Lewes in the laboratory. Much has also been done by the numerous inventors who have aimed at the prevention of the striking-back of the flame in gas-fires; and, in another department of labour, by the great crowd of those who have worked at the improvement of the Welsbach system of lighting. Notwithstanding all that has been achieved in these regards, however, the study of the phenomena of flame remains one of the most fascinating of all the branches of the science of chemical physics.

An exhaustive book on "Flame" remains to be written; and the literature of the subject must be sought for in the general writings of natural philosophers—to use an old-fashioned term which appears to cover the greater number of those scientific inquirers who have discoursed upon the phenomena of flame from various standpoints. Though it might have been thought that the nature of flame was pretty well understood a long time ago, it was left to Mr. Frederick Siemens to point out the practical importance of allowing all flames to burn themselves perfectly and completely out. The modern advance in the employment of flames for industrial uses in general really dates from this discovery. Previously to this, while it was, of course, accepted that contact with a cold solid body of a flame liable to deposit soot, in this condition, was to be avoided, it was not equally understood that a simi'ar condition was detrimental to any flame, though it might be smokeless. Mr. Siemens pointed out that, in the internal economy of all flames, perfect completion of the process of combustion was the most important condition to be preserved. He showed that the visible objection of the soot deposit, when a luminous hydrocarbon flame is chilled and partly extinguished by contact with a foreign body colder than itself, is paralleled by the invisible waste of combustible gases which goes on when a non-luminous flame is chilled and partly extinguished. Therefore it is to him that the principle of the large combustion chamber of all good modern furnaces is to be credited.

Modern furnace practice resolves itself into a compromise between the desirability of saving combustible by allowing it to burn to the best advantage, and the necessity for bringing the object to be heated into the closest proximity to the hottest portion of the fire. In all the common applications of the bunsen burner, this is the two-fold nature of the problem of efficiency. The object is not to spoil the flame, but yet to get the heat where it will do most good. In the incandescent burner, the accurate fitting of the mantle to the flame is half the secret of efficiency. In the construction of gas-fires and heating apparatus generally, the best results are obtained when the object to be heated is bathed in the hottest inert products of combustion immediately after the process of actual burning is completed. It is difficult to ensure this kind of contact in the rough conditions of ordinary service; and in order to make quite sure of there being enough heat available for the work to be done, usually the atmospheric flame is too big for its object. Consequently, when the freshly-lighted flame impinges upon the cold substance plunged into it, the result is imperfect combustion. The gas is partially extinguished while burning, with the familiar effect of producing abominably smelling "fumes," which are certainly noxious.

This theory of the necessity for avoiding contact between actual flame and any object to be heated, has been disputed by some, who point, by way of calling rebutting evidence, to the blowpipe and the well-known action of projecting studs in kettle bottoms, in expediting the boiling of the water. The latter phenomenon, however, has nothing to do with the process of combustion, but is connected with the transmission of heat to fluids—a different matter altogether. With regard to the blowpipe, to which class of appliances every bunsen burner belongs, its real purpose is the concentration of flame-temperature at a particular point, not the most economical application of the combustible. Even so, two blowpipes with equal and opposite flames meeting at the working zone are better than one; and this is the way in which the blowpipe flame is used in metal-working whenever possible. The less of the blowpipe action there is in the bunsen flames commonly used for other purposes, the better. The fact of the partial extinction of the flame by contact with a cold body is further demonstrated by the diminution of the offensive fumes as the surface grows hotter, and the volume of the flame is adjusted to its work.

Still, where a gas-flame, whether luminous or atmospheric, is brought into contact with a foreign body, or is otherwise deprived of the quantity of air it wants to complete its combustion, there must be imperfect combustion at that point. It does not necessarily follow that the unburnt gases escape into the atmosphere; because, under favourable conditions, they may burn later on. This phenomenon of after-combustion may often be witnessed in an incandescent gaslight. There is above the mantle a dim halo of flame which recalls the flame-cap visible at night on many a factory chimney. This gas is therefore not doing any harm, even if it represents a waste. But where the products of imperfect combustion do not get a chance of burning out, as in many forms of gas-heated tools, such as laundry irons, and usually where a bunsen has struck-back, the result is a nuisance undoubtedly prejudicial to health. It would be doing the good cause of the gas industry a disservice to blink the truth. This is a class of nuisance which must be avoided and suppressed by every possible means, known or to be discovered.

It is recognized that the combustion of a flame of mixed gases is selective; the brightest components burning first. Thus, in a gas-flame, the hydrogen and the methane are the first to burn; and the richer hydrocarbons are primarily baked into acetylene, which decomposes later (Lewes). The carbon monoxide burns last of all. The point at which the sulphur impurity burns has not been determined. At any rate, the conclusion which it would seem logical to draw from the known data is, that when a gas-flame is caused to burn imperfectly or incompletely, the products will contain perhaps acetylene, almost certainly carbon monoxide, possibly some heavy hydrocarbons, and a little sulphurous acid. The mixture would be likely to smell offensively, as we know it does; and it would certainly be injurious to health if breathed. There are singularly few reported cases of personal injury directly and solely attributable to poisoning by imperfectly burnt gas. An example, however, occurs in the Factory Inspectors' Report for 1902 (p. 168). The cause of injury here was "a defective ironing machine emitting noxious fumes." It was only described as a "shirt machine;" and there was evidence that it was used in a condition admitting of the escape of carbon monoxide. Conviction and a fine followed. Miss Deane, one of the Lady Inspectors, remarks on the condition of the atmosphere, at ten o'clock at night, of a room in which gas-heated machines had been running since eight in the morning. "The girls bend over the machines of the gas-heated flat-iron all the time; and complaints that the

fumes hurt their eyes, give them headaches, and that they 'taste' gas are often made." It is one of the most remarkable failures of chemical science that it does not provide quantitative determinations for amounts of gaseous emanations in the atmosphere which are very plainly perceptible by the unsophisticated senses of taste and smell. The worst of this dependence on the senses for warning when the air breathed is contaminated, is that use deadens the sensibility to what is amiss; so that harm is insidiously done before the process is detected.

The main purpose of this article, therefore, is to direct attention again to a most important aspect of the employment of gas in dwelling-houses and workshops, in order that, if possible, instrumental means may be devised for detecting the existence of the state of the atmosphere in which the taste or smell of the products of the incomplete combustion of gas would be noticeable. Nobody knows for certain what it is that smells so offensively in these products, and it is high time that this was ascertained. There is no doubt that different makes of gas cooking-stoves vary considerably in their tendency to give off a bad smell. Many houses in which gas-stoves are fixed announce the fact the moment the front door is opened. This cannot be right; but there is, obviously, a measure of excuse for the offenders while it remains impossible to check the nuisance by some incontrovertible test.

Before leaving this subject for the present, it should be remarked that there is nothing in what is already known of the subject to connect the composition of the partially-burnt combustion products of gas with its original chemical analysis. Everything in illuminating gas burns to carbonic acid and water, with a little sulphurous acid—that is, with complete combustion. When the gas-flame, whether luminous or atmospheric, is interfered with, these combustion products are contaminated with others of a less innocuous character; but they are due, probably, to the act of interference itself, less than to anything that was originally present as a combustible in the gas. What the combustible components were, in effect, is probably immaterial to the ultimate result, because the act of destroying and partially putting out a flame is quite enough to account for the presence of carbonic oxide in the products. At any rate, so it appears on a survey of the operation. The subject calls for full investigation.

PRESENTATION TO MR. J. W. HELPS.

An interesting event took place at the Croydon Gas-Works on Tuesday morning last, on the occasion of the return of Mr. J. W. Helps, the Engineer and General Manager, who, under the orders of his medical advisers, has been on a tour through India. Having been away about three months, his return was made the occasion of a hearty welcome by the whole of the staff and workmen of the Company, who, to show their esteem and respect, presented him with a silver inkstand suitably engraved, an oak library roll-top desk, and an illuminated address, subscribed for by 341 of the employees. The words on the address were as follows:—

> Presented to J. W. Helps, Esq., M.Inst.C.E., together with a desk and silver inkstand, by the Workmen and Staff of the Croydon Gas Company, as a token of their respect, esteem, and welcome, on the occasion of his safe return from India. February, 1904.

The Chairman of the Company (Mr. Charles Hussey, J.P.), supported by the Secretary (Mr. W. W. Topley), the Assistant Manager (Mr. A. Caddick), and the staff, in a kindly speech welcomed Mr. Helps, and stated how pleased they were to see him among them again once more, having returned well in health. The presentation was made, on behalf of the employees, by Mr. T. Shadbolt, who has been in the Company's employ for 37 years. Mr. Helps, rising amid hearty applause, feelingly acknowledged the gift. He said it was difficult on such an occasion to find suitable words to express his thanks. But he was much gratified to see that those whom he had left behind him were present to welcome him back. It gave him great pleasure to know that during his absence one and all, to the best of their ability, had endeavoured to fulfil their respective duties. He wished particularly to say that, gratified as he was by the presents themselves, he was still more pleased at the spirit which had prompted the donors to think of him.

London County Council's Gas Bill to be Withdrawn.—The second reading of the Bill promoted by the London County Council to amend the Gaslight and Coke and other Gas Companies' Acts was down for second reading, by order, last Tuesday; but it was deferred for a week. It now appears that the Bill is not to be further proceeded with, as a recommendation to this effect stands at the conclusion of a report by the Parliamentary Committee of the Council on the *agenda* for the meeting to-day. The reason for the recommendation is that the Committee have been informed by the Board of Trade that, having regard to the sitting of the Departmental Committee, they think the measure should be withdrawn. The Parliamentary Committee consider that, under the circumstances, the Council will wish to act upon the suggestion of the Board.

THE WEST COMBINED CHARGING AND DRAWING MACHINE.

New Features and Experiences.

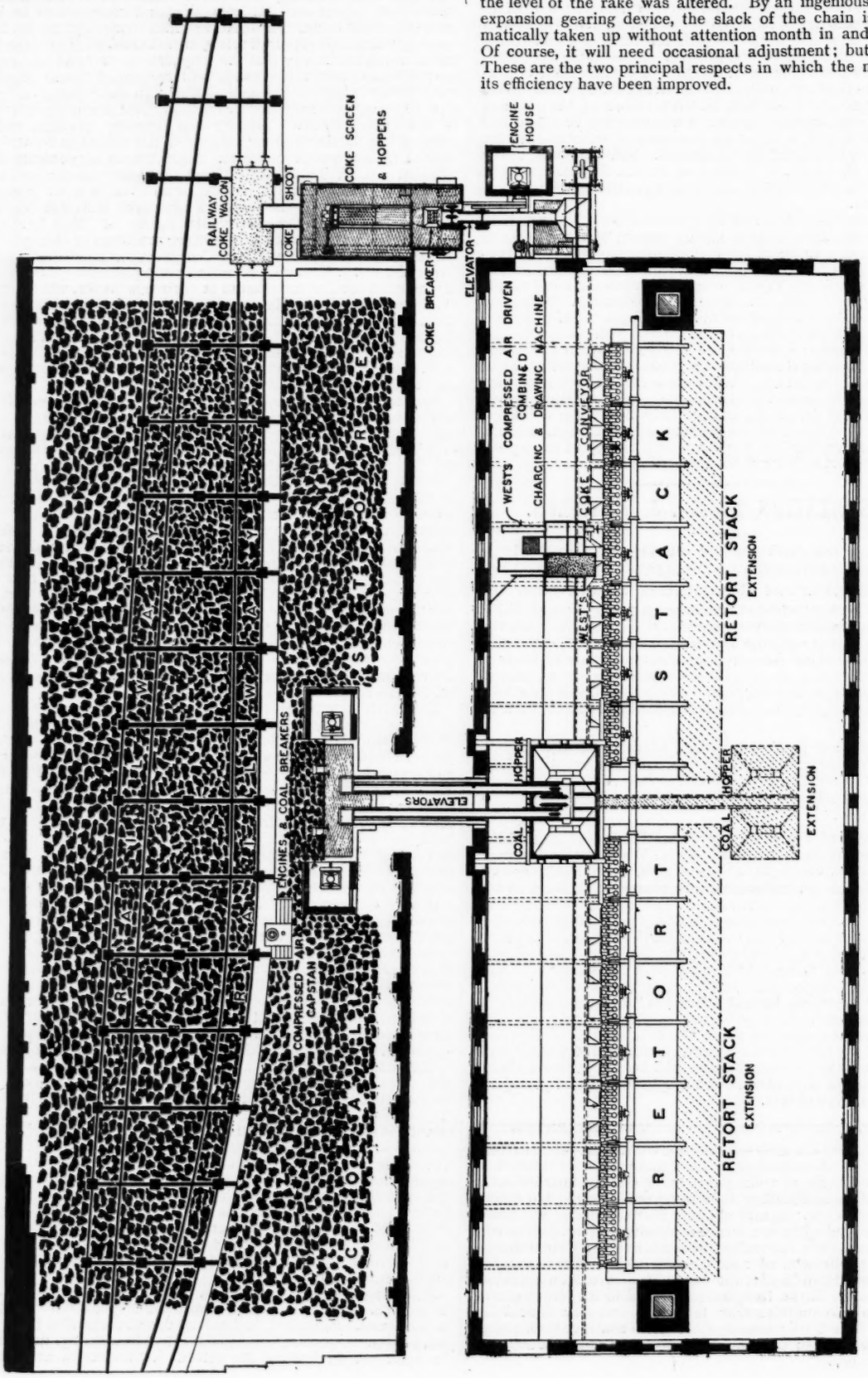
Improvement is the order of the day in connection with retort-house machinery; but, verily, if improvement can be carried much further, there will be nothing left to improve upon in respect of time and costs. Among those whose endeavours never seem to rest in this respect are Mr. John West and those whom he has gathered around him. In whatever other types of plant the firm have gained a high reputation, it is in and around retort charging and drawing machinery that the thoughts of the head are more specially and constantly moving, with the view, of course, of going "one better" than he has gone before. In the "Journal" for Dec. 16, 1902, we described fully his then latest product in this line. It was the combined charging and drawing machine, which enabled the clearing and recharging of the retorts to be accomplished by one power machine. Later on, an opportunity was afforded of describing the installation of the first machines of this pattern at Ipswich, and it was reported then in what respects there were improved variations as compared with the machine that was inspected several months before at Miles Platting. Although Ipswich was the first to have machines of this type installed, the Wellingborough Gas Company, on the advice of their Engineer, Mr. J. T. Lewis, were the first to place an order for one of the machines for installation at their new works, which, however, were not at the time ready for its reception. Upon this point, the Company were, as it happens, a little fortunate; for in the meantime there has been, in two important parts and operations, improvement, which, compared with the original, have increased the efficiency and ready adaptability of the machine to the varied ranges at which it is required to work.

The stages of improvement in any machinery absorb a considerable amount of time, and exercise of the mind, in experiment. So have the new improvements—easy though they are of explanation—of West's combined charging and drawing machine. However, Mr. West regards his latest success, as exemplified at Wellingborough, as being entitled to the top place among his previous inventions for ingenuity and completeness. Having seen the machine which has been installed at Wellingborough, and witnessed its action, we do not feel there is any room to question Mr. West's estimation of the constitutional and working character of his new progeny. He is going to call the machine the "Positive" charger. It may be respectfully suggested to him that the term "positive" is played out, and that West's "Mono" retort machine would be a more suitable title. Let us see. One machine for charging and discharging, one man to a machine, one scoopful of coal constituting a charge, one projection into the retort—and the charge is completed. One machine, one man, and (if not in the rake work), in the charging, one operation. Therefore, let it be, Mr. West, the "Mono" retort-machine.

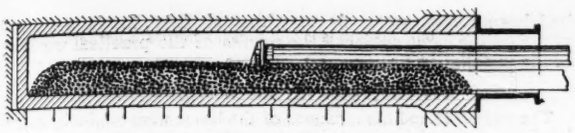
The machine must be left for a little explanation. The first, as stated, of the improved type has been put into the new works of the Wellingborough Gas Company; and it was there, through the permission of Mr. Lewis, the machine was recently inspected and its working results examined and inquired into. The new works are yet some months from completion; but the retort-house plant has been finished to a point which has permitted of the discontinuance of manufacture at the old works. When the new works reach the complete state, there is to be a formal opening, and to that time, or thereabouts, the publication of a full description of the works is being reserved. For present purposes, it is sufficient to say that the retort-house and coal-stores run parallel with each other and the Midland Railway sidings; the coal being delivered into the coal-store from an overhead railway. The retort-house has been designed to eventually contain 14 beds of through retorts, or 28 beds of singles. At the present time, seven beds of eight retorts, each 22 in. by 16 in. by 10 ft. long, have been completed, and are being operated by the new machine. On the other side of the passage dividing the benches, an equal number of settings, in every respect similar, are now being built. When these are completed, and as soon as required, they will be put into operation, and be dealt with by the one machine, and operated by the same number of men as now, with perhaps an additional man to render assistance generally in the house. The settings have been specially designed for machine work, and erected with the best fire materials in the combustion chambers and settings, combined with good workmanship for standing high temperatures. Further description of the house at present is limited to this: The house is fitted up with coal-handling machinery (the coal-hoppers for supplying the machine being of 60 tons capacity), and hot-coke conveyors running under the stage-floor, and fed through shoots. The arrangements (as will be seen by the plan given on the next page) are very complete for the handling of both coal and coke; and this completeness and judicious arrangement are only typical of the general scheme on which Mr. Lewis has laid out the entire works.

Returning again to the machine. To all intents and purposes, the new charger is Mr. West's improved manual machine, only strengthened, lengthened, and enlarged, and suspended from one end, so that no portion touches the retort in entering, depositing the coal, and in leaving the retort. In this case, as already

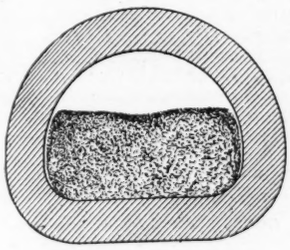
foreshadowed, the machine has been improved so that it effects its charge at one stroke. In its predecessor, the scoop had to be filled twice, and enter the retort twice, to complete the charge. Here the scoop has been enlarged and is of the divided type, so that when it has completed its journey into the retort, each side turns over outwards, and deposits the coal well up against the sides of the retorts, exposing the coal to a larger amount of heated surface than when banked up towards the centre of the retort. When the charge is in, there is quite a channel running down its centre, which characteristic of form is maintained to the end of carbonization. We give an illustration of a section of a retort showing the spent charge; but the channelling of the spent charges seen at Wellingborough is even more pronounced than portrayed by the illustration. It must be admitted that this charging of the retort by a single propulsion is a considerable step in advance of the first machine; and represents an appreciable saving in the time that the lids of the retorts throughout a charge are open. But more about this presently. Another improvement has been effected on the rake side of the machine. With the raising and lowering of the rake in the former type, the chain was taken up or released by a drum at the top of the machine; and this required the attention of a man every time the level of the rake was altered. By an ingenious and strong expansion gearing device, the slack of the chain is now automatically taken up without attention month in and month out. Of course, it will need occasional adjustment; but that is all. These are the two principal respects in which the machine and its efficiency have been improved.



PLAN OF THE RETORT-HOUSE AT THE WELLINGBOROUGH GAS COMPANY'S NEW WORKS.



THE CHARGER RECEDING AFTER DELIVERING THE COAL INTO THE RETORT.



SECTION OF THE BURNT-OFF CHARGE.

The seven beds in the new house and the machine have only been in use a few weeks. It follows that the men are quite fresh to the work; and, in fact, men and machines have only just been released from the tutelage of the Contractors' representatives. Work, too, is a little bit irregular as yet. But, with all these disadvantages, the speed and expeditious way in which the new machine is handled at Wellingborough is a matter for notice. Seven retorts were timed; and their discharging and charging took only seven minutes (ordinary and not exhibition work), including the necessary movement of the machine from retort to retort.

When the machine is in position, it only takes six—say eight seconds to charge a retort in the manner already described. In the twenty-four hours, there are five charges; and, as stated, two men do the whole of the work of each twelve-hour shift. Their time even then is not more than half occupied; so that with the assistance of an additional man, they will be able easily to discharge all the duties attaching to the fourteen beds when the second bench is completed. The one man on the machine draws and charges the retorts, and the other opens and closes the lids and augurs the pipes. From the foregoing figures, it will be seen that, if it were necessary, the whole of the retorts could be dealt with by the machine and these men at the rate of sixty per hour. Consulting the records which have been kept by Mr. Lewis so far, it is seen that, including drawing and charging, attention to fires, pricking up and clearing ash-pans, and oiling and cleaning up the machines, the men are not at work more than (say) six hours out of the twelve. Therefore the work is far from laborious; and it appears evident that, when the half of the house (the fourteen beds) is in full operation, the working costs per unit of production or per ton of coal will be further reduced.

In the opening of this article, we spoke of the narrowness to which time and costs are being reduced by the new retort-house machines; and the point to which the figures at Wellingborough have been brought down suggests that the penultimate stage must surely have now been passed. Mr. Lewis was a little chary about these figures being published, because it is not always possible, under changing circumstances, to work up to costs which are of such super-excellence. This explanation will relieve him of any feeling that this publication has chained him to these particular figures for the future. They represent the results of experiments with the machine on the seven beds or 56 retorts. In twenty-four hours, the amount of coal used, as carefully weighed, was 51 tons; the charge of coal delivered into each retort being 410 lbs. or 2050 lbs. per single retort per 24 hours. The cost for labour for carrying out the whole of the operations in the 24 hours was as follows:—

Working Expenses for the New Machine.

	£	s.	d.
Two men charging and drawing retorts per shift, or four men per 24 hours at 5s. 6d.	1	2	0
One man unloading coal during day for both day and night shift		4	2
One man attending to coke-handling machinery and filling railway waggons; the coke being delivered into hoppers at night, six hours at 5d.		2	6
Total cost per 24 hours	1	8	8

The total cost per ton of coal carbonized, including unloading the coal from waggons into coal-breaker, and elevating the same into large hoppers, drawing and charging the retorts, augering pipes, attending to regenerator furnaces, conveying coke into elevator, breaking, or screening and delivering same into railway waggons or large coke-hoppers, is therefore **6·74** d.

This, we repeat, is a remarkably low charge; and with it very naturally both Mr. Lewis and Mr. West are highly delighted. Whether it will actually be further reduced when the fourteen beds are in full work, is a matter for the future. There is no apparent reason why it should not be. But the less said about this the better until experience with the second bench is before us. Sufficient for the day is the present success.

ELECTRIC LIGHTING MEMORANDA.

Electric Lighting of Marylebone: Proceedings in Parliament—A Defect of Local Government—The Responsibility of Citizens—A Chester Lighting Controversy.

THE Electric lighting question of Marylebone has entered upon another stage. The Bill of the Borough Council was read a second time in the House of Commons last Tuesday; and immediately afterwards Mr. D. Ford Goddard placed upon the notice-paper the terms of a motion which was ordered to be considered at the time of private business to-day. This was that the Committee should be instructed to insert in the Bill the well-known Bermondsey clause; making it imperative upon the Council, after the first year's working of the electric lighting undertaking, to make their accounts balance. This is perfectly fair, in the circumstances, as the undertaking to be acquired is a going concern, for the goodwill of which a round million sterling is to be paid. But the principle of the Bermondsey or Beckenham clause, as it is sometimes called, is incomplete. It ought to be rounded off by a direction that, in fixing the various rates of charge for different classes of consumers of electricity provided on the security of the rates, no injury shall be inflicted on one class of consumers and ratepayers for the unfair benefit of another. Actually, this is done to a very large extent by many, perhaps the majority of local authorities carrying on electricity supply. Not only do they frequently offer electrical power notoriously under cost price, but habitually under-charge for the street lighting. Any losses suffered on these accounts either fall upon the other consumers or upon the rates, which are largely borne by local interests in nowise concerned in the matter. Nor is this all. The injustice which is inflicted upon railway, water, and gas companies also comes upon heavily-rated factory and workshop owners, the large retail shops, warehouses, banks, and other short-time users of artificial light. Wherever the Brighton system of charging for the electric light is in force, all these interests are victimized for the sake of long-period consumers, the majority of whom are lightly rated.

Meanwhile, the serious defect in local government law revealed by the inception and subsequent course of the Marylebone purchase scheme, has been brought under the notice of the Local Government Board by the Ratepayers' Committee. The point is, that in 1901 a contract committing the Borough Council to the purchase of the undertaking was entered into without the knowledge or consent of the ratepayers. In all the troubles that have since arisen over the arbitration award, and the inability of the Council to complete the purchase without further parliamentary borrowing powers, the ratepayers have had to face accomplished facts, and have had, moreover, a pistol at their heads in the shape of an order from the High Court for specific performance. The ratepayers have had to choose between the two courses equally obnoxious to them—between allowing the Council to go on with their speculative enterprise or defying the High Court. As the less of two evils, the ratepayers have chosen the former alternative. In the circumstances thus created, the Marylebone ratepayers consider that the fiction of there being any effective control on their part over the doings of the Borough Councillors ought to be exploded. Accordingly, they have made representations to the Local Government Board to the effect that no Municipality should be allowed to make contracts or Private Bills involving a charge upon future years, unless a majority of two-thirds of the electors have previously signified their approval. The object is to place some substantial check upon the headstrong proceedings of temporary members of a local authority, who, under the existing system, can in a few months saddle a locality with obligations which two generations of ratepayers can hardy discharge.

Obviously, the question at issue here is a very wide one, and requires to be dealt with by Parliament on very much broader lines than are suggested by the legitimately incensed large ratepayers of the Metropolitan Borough of Marylebone. It is quite true that the particular examples of electric lighting and electric tramway working have served as touchstones of the wisdom of British local authorities, who have rarely come well out of the ordeal. But this is only one branch of municipal enterprise, which in many other respects—water supply, gas supply, harbours, and even sewerage—must necessarily challenge fortune and essay things that cannot be undone for generations, if at all. Local governing bodies must take risks; and if these are occasionally mistaken, the locality must bear the consequences. It by no means follows that the collective wisdom of two-thirds of the ratepayers at any particular period will prove more trustworthy than that of the elective authority which is charged with transacting the ordinary routine work of the community. It is only too notorious how, now and then, some public agitator and demagogue, without a sane idea in his head, can sway public opinion to his will; and if this style of thing were encouraged, the lot of communities would scarcely be ameliorated. The best hope appears to rest in an awakened sense of their public duty on the part of the best men, whatever their social degree, in every place. If Marylebone is now suffering from the rashness of small and ignorant men in office, that is both the misfortune and the fault of the ratepayers. The same tale is told everywhere. The tools of local government fall into the hands of those who are

willing to use them; and if men who might serve the public better are too dignified or busy (or idle) to assert themselves, the commonwealth must suffer loss.

A curious little illustration of the way in which a municipal electric lighting competition with gas is advertised, comes to hand from Chester. Here the Gas Company have issued a circular stating some plain truths about the comparative efficiencies of incandescent gas and electric light, which the City Electrical Engineer was evidently called upon to deal with. This is how he does it: Admitting that an incandescent gas mantle "may" give an average illumination of 60-candle power, it is remarked that as it only does so when the gas pressure is right, that the greater part of the radiation is in an upward direction (?), that the average illumination below the horizontal is only 40-candle power, and that even these figures are only true of new and naked mantles, it follows that a 16-candle electric incandescent lamp is quite equal to it for practical purposes! This is taking the bull by the horns, with a vengeance. If the efficiency of both rival lights is to be knocked down in this Dutch auctioneer's style, how would the so-called 16-candle electric lamp fare? Is it always what its name implies, in Chester? Because, if so, the experience is unique. But, as if this claim were not enough for electricity, it is said that the "new Nernst lamps" are going to considerably reduce the cost of electricity. Of course, this is always about to happen; but it never does. With regard to the Nernst lamp, whatever its cheapness, which is questionable, its performance is anything but according to the listed duty. There are such things as portable photometers, and where electric lighting is opposed to incandescent gas, these instruments reveal some startling truths. We have heard of such things as "2000-candle power" arc lamps averaging in fact less than 300 candles, and 50-candle power Nernst lamps showing about 26 candles actual. If the Chester Town Council desire to see these statements corroborated in their own case, there will be no difficulty in the way. Accurate photometry of electric lamps, however, is not a practice favoured by municipal traders in electricity—for good reasons. Nobody can tell what the illuminating power of a light is by looking at it; and it is more reposeful for local authorities to pretend that their electric lamps are giving their nominal quantity of light without inquiring too curiously into the fact. One useful piece of information concerning the electricity supply business in Chester transpired incidentally in the course of this little controversy. The Electrical Engineer stated that the average number of hours during which the lamps connected to the city mains in the year 1902 were burning was 474, which strikes one as more to the credit of the citizens for keeping good hours than advantageous to a lighting business.

HEAT-CONDUCTION THROUGH BRICKWORK.

Communicated by Mr. GEORGE BEILBY.

IN the suggestive article on the "Heating Properties of Fire-Clay Retorts," in the last number of the "JOURNAL," the following remarks occur towards the bottom of the first column of p. 464:

Supposing it is wanted to know, for example, about what would be gained in heat-transmission by reducing the thickness of a retort or tile from 3 inches to 1½ inches, who can refer to satisfactory data in point? The answer is an echo. The information does not exist; and any conclusion on the subject must, therefore, be the merest guesswork.

About twenty years ago, my attention was specially directed to this subject, in connection with the use of externally heated fire-clay retorts for the gasification of coal by means of steam and air (Young and Beilby patents, 1881-1884); and the following remarks occur* in a paper read before the Society of Chemical Industry in April, 1884:—

The available published figures for the loss of heat through the brickwork of retort-benches are so manifestly inaccurate, that new determinations of the conducting power of fire-brick were made. The method employed was similar to that used by Peclet ("Ann. Ch. Phys." 3, ii., 107); but instead of using the small differences of temperature to which one is restricted when water is used on both sides of the conducting medium, large differences, of 260° to 300° C., were maintained by the use of a lead-tin heating bath. A detailed description of these experiments would be out of place here; but the general result showed that one square foot of fire-brick 1 inch thick passed 6·59 heat units per hour for each degree of difference between the temperatures of the two sides of the diaphragm. From this it was calculated that the loss over the whole apparatus amounted to about 2 million units per ton of coal treated.

This result was found to be in fair agreement with the more extended experience which was gained in working on a still larger scale.

Again, in a paper read before the same Society in May, 1885, on "A New System of Cooling Oils for the Extraction of Paraffin,"† the following remark occurs:—

From experimental determinations of the conducting power of brick, it is estimated that the heat passing into the house through floor, walls, and roof will amount during the heat of summer to the equivalent of six tons of ice melted per day.

In this case, the data were used in designing a large installation of cooling plant. The result fully justified the estimate, which had been based on purely experimental data; for in a second paper on the same subject,* the results of the practical working of the installation are given as follows:—

The Temperature of the Cooling-House.

The apparatus and the structure of the house were originally calculated and designed for the maintenance of the air inside, summer and winter, at a temperature of 32° Fahr. The cooling-house is 56 feet long, 48 feet broad, and 25 feet high. Its cubic capacity is therefore 67,200 cubic feet; and, after deducting the volume of the contained apparatus, the actual air space within the house is 58,900 cubic feet. The internal wall surface is 5200 square feet, the roof and floor surface 5376 square feet, or a total internal surface of 10,576 square feet. The cooling of the air of the house is effected by the exposed surfaces of the ends of the brine cells amounting on an average to 1600 square feet at a mean temperature of about 20° Fahr.

The refrigerator is one of Pontifex and Wood's ammonia machines, with a nominal ice-making capacity of 9 tons per 24 hours. During the months of June, July, and August, though the apparatus was in pretty full work, there still remained many details to be adjusted; but the general cooling results were very satisfactory. For the week ending the 25th of July, the following were the readings of thermometers inside and outside the house:—

	Outside Thermometer on North Wall.		Inside Thermometer 5 Feet from Floor in Centre of House.
20 July, at 1 p.m. . . .	62°	..	31·5°
21 ,, ,, . . .	60	..	30·5
22 ,, ,, . . .	62	..	30·0
23 ,, ,, . . .	72	..	32·0
24 ,, ,, . . .	74	..	32·0
25 ,, ,, . . .	79	..	34·0

For the week ending the 19th of September, the following are the readings:—

	Outside Thermometer on North Wall.		Inside Thermometer, 5 Feet from Floor in Centre of House.
14 September, at 3 p.m.. .	56°	..	28°
15 ,, ,, . .	62	..	29
16 ,, ,, . .	58	..	29
17 ,, ,, . .	58	..	29
18 ,, ,, . .	60	..	28
19 ,, ,, . .	56	..	28

The refrigerator was doing about half work during this week, as we have found that 27° or 28° is a sufficiently low temperature for the air of the house; at lower temperatures the oil filters sluggishly.

The lowest temperature ever observed on the inside thermometer was 26°, and the greatest difference between the outside and inside thermometers was 45°. Of course, the temperatures on the south and west walls, in the direct rays of the sun, must often have reached 90° to 100°; giving a difference of 65° between the outside and inside.

It is of interest to note that the experimental data as to the conductivity for heat of fire-brick and similar materials, which had been called for by a high-temperature operation in 1884, were successfully used in designing a low-temperature plant in 1885. No one who knew the old laboratory at the Oakbank works would expect that physical data of a high order of accuracy could have been arrived at in it; but it is specially for this reason that the illustration here given may be supposed to have a value in connection with the question you have raised. The moral appears to be that in modern gas-works, with their vastly superior laboratory and staff equipment, there is no reason why all these and many similar questions should not be authoritatively settled in a few weeks or months.

Writing on the same subject, a well-known firm of Stourbridge fire-brick and retort makers (who do not desire a "gratuitous advertisement" by having their names mentioned) write: We have read with much interest the article in the "JOURNAL" for Feb. 23 on the "Heating Properties of Fire-Clay Retorts." We have recently begun in a small way to make systematic and regular tests of our materials, but have not so far made any tests as to the heat transmitted through varying thicknesses. While agreeing in the main with the "JOURNAL'S" remarks as to the lack of research in questions like this on the part of makers, we cannot help thinking that it is to a large extent due to the fact that makers have been in the dark as to what was wanted of them. We ourselves, for instance, in other branches of our trade have found that only a very small percentage indeed of users of fire-clay goods understand what the fire-bricks have to face in actual use in the way of temperature, and of chemical and physical action, whether detrimental or otherwise. We think, therefore, it is hardly fair to blame the makers in such a wholesale fashion for the present state of things. As far as we are concerned, we shall be only too glad to work along the lines suggested in the article, or for the matter of that, in any other direction in which the quality of Stourbridge fire-clay goods can be improved. We have already done some work in this direction, and are at the present moment prepared to offer a material which we think would give perfectly good results for retorts, while enabling the walls to be much thinner. The cost, however, of the process by which this is prepared, makes it very much more expensive than the ordinary fire-clay retort; and our experience has been that it is only a few of the more enlightened gas managers who will even consider anything but the cheapest first cost. We would like everyone to know that if any possible means of improving the efficiency of gas-retorts could be pointed out, we at any rate are quite prepared to take the matter up. With regard to the temperatures referred to in the article, we would point out that, while the temperature of carbonizing is probably somewhere about 1500° Fahr., there are places in the furnace where it certainly reaches 3000° to 3500° Fahr., and where only the very best of fire-clays will stand.

* See "Jour. Soc. Chem. Ind.," Vol. III., pp. 222-3.

† *Ibid.*, Vol. IV., p. 325.

* See "Jour. Soc. Chem. Ind.," Vol. IV., p. 653.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Annual General Meeting of the Association was held last Thursday, at the Grand Hotel, Birmingham. The excellent attendance which has been a feature of these meetings for some time past was well maintained on this occasion. The outgoing PRESIDENT (Mr. Charles Meiklejohn, of Rugby) was in the chair during the first part of the proceedings.

The HON. SECRETARY (Mr. A. Cooke, of Oldbury) read the minutes of the autumn meeting held at Walsall on Oct. 22; and on the motion of Mr. B. W. SMITH (Walsall), seconded by Mr. J. FERGUSON BELL (Derby), they were confirmed.

ANNUAL REPORT AND ACCOUNTS.

The PRESIDENT moved, and Mr. W. A. SAPEY (Tamworth) seconded, the adoption of the annual report and accounts. The former reviewed the proceedings of the year; and, in the final paragraphs, stated that six new members had joined during the year, two members had died, and two lapsed under Rule 15—leaving a membership of 101. The Committee recommended, as in former years, that the volume of "District Association Reports" should be presented to all members not in arrear. The accounts showed that, including the £125 brought forward, the receipts for the year amounted to £175, and that there was a balance in the bank and in hand of about £107.

The report was unanimously adopted.

NEW MEMBERS.

The names of Mr. Harry Haddock, of Atherstone, Mr. W. H. Thomas, of Alcester, and Mr. H. J. Ibbotson, of Newport, (I.W.), were added to the roll of membership.

THE AFFILIATION QUESTION.

The PRESIDENT said the next question for consideration was that of the affiliation of the District Associations with the Institution of Gas Engineers. The matter had been considered by the Committee, and on lines which he would endeavour to briefly put before the members. They had unanimously recommended affiliation with the Institution. As the members were aware, the question arose, in the first instance, by reason of two sections in the Articles of Association of the Institution (Articles 77 and 78), which were as follows:—

> 77.—The Council may, at their discretion, upon the receipt of a request from a sufficient number of members or associates resident in any district, create a Local Section of the Institution in such district; and they shall also have power to dissolve such Section at any time after it has been formed.
>
> 78.—Each Local Section shall be constituted, and its affairs shall be carried on, in accordance with the rules and regulations to be laid down from time to time by the Council.

These were the portions of the Articles of Association of the Institution on which the idea was originally founded. Well, then they came to the remarks of Mr. Andrew Dougall in his Presidential Address to the Institution, in which he spoke strongly as to the advisability of affiliating the District Associations with the Incorporated Institution of Gas Engineers. Now there were one or two objections to affiliation that presented themselves to his (the President's) mind, as referred to in these articles; and it seemed to him that it would be necessary for some modification to the articles to take place before affiliation would be possible. He was quite sure that this, and every other District Association, while having no fundamental quarrel with "creation" in general, would—after an existence of 25 years or more of sturdy and vigorous growth—strongly object to be created once more by the Incorporated Institution of Gas Engineers, and would therefore be not only reluctant but strongly opposed to giving their assent to any proposition which would put the power into the hands of the Council of the Institution to dissolve this Association or Local Section at will. There was also a further objection in reference to the allusion in Article 78 to the rules and regulations under which the Local Sections were to be conducted. He thought the members would agree with him that the rules of the Association should be accepted as the rules of the Local Section, and should not be subject to variation or alteration without the consent of the Local Section. He might very briefly state the lines on which the Association Committee had agreed to recommend affiliation. They were these—

> (1) That the rules of the Association shall be the rules of the Local Section, and shall not be subject to revision or alteration without the consent of the Local Section.
>
> (2) That the management of the Section shall be in the hands of the Committee appointed by its own members, and the finances of the Section under the control of the Committee.
>
> (3) The President for the time being of the Section shall be *ex-officio* a member of the Council of the Institution.
>
> (4) That members of each Local Section (who are qualified to become members under the Articles of Association of the Institution) shall be eligible for election to the Institution without entrance fee.

As this necessitated practically the appointment of an additional member of the Council, whose expenses would naturally be borne by the Institution, as at present in the cases of other members of the Council, the Committee thought it would be well for the Association to agree to an affiliation fee, and it was proposed that 5 guineas per annum should be the fee suggested by the Association; so that practically, while retaining their own independence in the control of the finances of their own Local Section, they would not be imposing any charge on the finances of the Institution. In this way, they really covered the expenditure that would be incurred by reason of their affiliation. He thought this practically dealt with the whole of the simple lines on which the Committee were agreed to recommend the members to adopt the resolution. There were one or two points in addition to these that were worthy of consideration. He felt strongly that to make affiliation a success, the wisest course would be to affiliate on lines which were at once simple and not too onerous for the Associations they wished should join with them. He was unable to see any reason why any Association which had been established for some years—whether their members were all eligible under the articles of the Institution or not—could not be affiliated with the latter; and he thought the fourth suggestion of the Committee "that members of each Local Section (who are qualified to become members under the Articles of Association of the Institution) should be eligible for election to the Institution without entrance fee," would safeguard the Institution from anyone becoming, through their membership of Local Associations, members of the Institution who were not otherwise qualified. It was just possible, too, that in a District Association there might be associate members or others who might possibly rise to the presidential chair, and yet who were not qualified for membership of the Institution. Some safeguard might also be inserted that no one who was not qualified for membership could become an *ex-officio* member of the Council of the Institution; so that it would apply to Presidents in that case, just the same as to ordinary members in a like position. Granting these provisions, he saw no reason why every Association should not become affiliated with the Institution. He should be pleased if the members would freely speak their minds on this matter, and come to some definite resolution with regard to it.

Mr. J. FERGUSON BELL (Derby) remarked that he was sure the members were all much obliged to the Committee for taking up this question of affiliation. It occurred to him, however, that perhaps it would be better, instead of their laying down certain rules, for them to elect two members of the Association to meet the Council of the Institution; and no doubt the other District Associations would similarly appoint members for the purpose of a conference. At such conference, they could perhaps formulate a scheme which the general members of this and other Associations could accept. As the President had pointed out, the Council of the Institution had taken powers in their Memorandum of Association to form Local Sections; but this would be rather a different thing from absorbing the Midland Association, which had been in existence a great number of years. Therefore, the rules of the Institution would require certain modifications. He did not think it would be advisable on their part to say what these modifications would require to be. Therefore, he thought it would be better if they elected the President, Vice-President, the Secretary, or any other gentleman to be a Committee to meet the Council of the Institution on this question. He remembered that some time ago, Mr. Charles Hunt (whom they were glad to see present) suggested that District Societies might be formed, and affiliated to the Central Institution on something of the lines of the Society of Chemical Industry. He (Mr. Bell) believed the Institution of Electrical Engineers also had District Societies. There was no doubt whatever that the well-known motto that "Union is Strength" applied as much to the gas industry as to any other industry; and he was certain himself that it would be to the benefit not only of the District Associations, but also of the parent Institution, if they could form one united body. These were times when they wanted to close up their ranks. There had been too many divisions; and he hoped this Association would not put anything in the way of affiliation. If they simply passed a resolution that affiliation was desirable, that would leave the Council to work out the lines on which it should take place.

The PRESIDENT observed that he might supplement what he had previously said with reference to the remark made by Mr. Bell. As a matter of fact, it would be necessary for this point to be submitted again to the Association before the thing was definitely settled, as it was necessary that the Articles of Association of the Institution should be modified to some extent. At the present time, they did not really know definitely what the Council of the Institution would be prepared to do, nor what they could do. But in regard to the appointment of members to assist the Council of the Institution in the discussion of this matter, he did not think he was betraying any confidence in stating that at the last meeting of the Council of the Institution it was agreed that the Presidents of each local Association should be invited to join the Special Committee appointed by the Council to consider this subject, and to formulate a scheme. But, at the same time, he thought it was desirable the members should discuss the matter from their own point of view, as some guidance to this enlarged Committee in

formulating the final rules. He would propose that the Midland Association of Gas Managers resolve to express their willingness to affiliate with the Institution, on somewhat similar lines to those he had explained. The details must come later, after the discussion between the Council and the representatives of the various Associations.

Mr. T. BERRIDGE (Leamington) seconded the resolution. He thought it was quite clear that it would be a great advantage for the Association to join, but on lines on which they could manage their own affairs. It would not do if they were to be put too much into leading-strings. If they could affiliate on the lines the Committee had discussed, it would certainly be a good thing.

Mr. CHARLES HUNT said, so far as he understood the position of the Special Committee in charge of this matter, all they desired was an expression of opinion from all the Associations; and then they would take these into consideration, with the view of formulating a scheme to embrace the whole. Of course, if there were any modifications in the scheme which had been proposed for this Association, they would come before the members and be discussed; and the question would be for their acceptance or otherwise. For his own part, he could not help feeling that the scheme which had been proposed for the acceptance or otherwise of the members, was one which should be agreed to. It was very desirable that, having regard to the long continuance of the Midland Association, and of its almost uniformly prosperous career, and its certainly very prosperous position at the present time, nothing should interfere with this prosperity in the future; but that the utmost possible liberty should be allowed it in order to ensure its going on expanding and continuing its career of usefulness. There were just two other matters as to which he should like to ask whether they had been considered. Would the title of the Midland Association be continued; and had it been considered as to whether the transactions of the Associations would be published in the present separate form, or would they be published with the "Transactions" of the parent Institution? He had much pleasure in supporting the proposition.

The PRESIDENT said, in answer to Mr. Hunt, that the view he had endeavoured to put before the Committee was that the Midland Association should retain their own name. It could be done in some such way as this: "Midland Association of Gas Managers. Founded 1878; Affiliated in 190— with the Incorporated Institution of Gas Engineers." In regard to the publication of the transactions, this had not been discussed; but he thought that it was a subject for consideration by the Special Committee. He was rather afraid the incorporation of all the reports would make the Institution "Transactions" rather cumbersome.

Mr. HENRY HACK (Birmingham) said he had come in late, and so had not heard the President's explanation; and he should like to know what were the advantages to be gained by affiliation. It occurred to him that, before this meeting, it would have been desirable to have had the proposals of the Committee forwarded to every member of the Association, in order that they might have considered them before the meeting. His own feeling was that they had now arrived at a position—a proud position (they had passed their century with regard to members)—at which he did not see they were going to gain anything by affiliation.

The PRESIDENT said he could only state, in reply to Mr. Hack, that the advantage was on the same lines as the amalgamation of the old Institute and Institution. They set an example which the members of the Institution desired to see extended, so as to include the District Associations, in order that the work would be uniform. The advantage, further, was that the President of each Local Section would be *ex-officio* a member of the Council of the Institution, so that each Association would always be in touch with what was going on in connection with the parent Institution. A further advantage was that a member of the District Associations would be admitted a member of the Institution without an entrance fee. Beyond this, he did not know that the advantages were more than sentimental. So far as their own Association was concerned, although they were quite strong enough to swim alone, he thought it was advisable they should join in the nominal allegiance to the Institution.

Mr. G. HELPS (Nuneaton) asked whether, if the Association did affiliate, they would be affiliated for all time, or, if the Institution displeased them in any way, could they withdraw?

Mr. H. FOWLER (Derby) remarked that the President had said the rules were to remain as at present. In any case of affiliation, it was absolutely necessary the rules of the District Associations should be the same. [The PRESIDENT: No, no.] He thought if there was to be any advantage in affiliation, it should be so; and it was a point that should be considered with some seriousness. It would seem to be an advantage, as Mr. Bell had suggested, if affiliation could be brought about on the same lines as the Society of Chemical Industry or the Institution of Electrical Engineers. They had a subscription to the head Institution which covered the subscription to the District Associations. If it were possible, he should like to know how many members there were belonging to the provincial Associations who were not members of the head Institution. At the same time, they should not look only at what would be of advantage to the local Associations, but at what would be to the advantage of the industry as a whole. They should look at the question from the point of view that they should do what they could to strengthen the principal Institution, rather than from the mere district point of view. He thought, if possible, they should arrange for all the members to belong to the Institution, and that subscriptions to the Institution should cover that to the district body.

The PRESIDENT said he could not agree with Mr. Fowler's opinion in regard to the necessity for uniformity in the rules of the Associations. The members, he thought, were all anxious for affiliation to go through; and he believed that a scheme could be formulated so that the present freedom of the District Associations would not be trenched upon by their affiliation with the Institution. If they adhered to hard-and-fast lines, the effect would be to exclude some of the Associations from affiliation; and he did not see why the Institution should so frame their rules as to render it possible to keep any Association from joining in this scheme. In regard to the proportion of members of the Institution who were members of the District Associations, he had with him a table prepared by Mr. Dunn for the consideration of the Committee when this question was first discussed. The total membership of the seven District Associations—namely, the Eastern Counties, Irish, Manchester District, Midland, North British, North of England, and Southern District—was 957, of which number there were belonging to the Institution only 418. Consequently, any inducement that might exist to become members of the Institution through Local Sections would be an advantage to the Institution, because the proposal to allow the members of the latter to enter the Institution without entrance fee was an inducement not only to join the Institution, but it would tend to strengthen the District Associations.

Mr. R. O. PATERSON (Cheltenham) said he was not an opponent of affiliation. He thought there would be a great advantage if all the District Associations were affiliated to the parent body; but he saw numerous difficulties in not being able to carry it as a whole. In their constitution, they did not admit secretaries; while secretaries were admitted to the Institution. Were the rules of the District Associations to be at variance on these points? [The PRESIDENT: Yes.] Taking the case of the North of England Association, he believed they admitted trading members. Were the rules of that Association to be altered so as to assimilate them to those of the Institution?

The PRESIDENT replied that they would not be altered; but he thought the resolution which he had suggested, and the lines on which affiliation had been recommended by the Committee, would enable the whole of the Associations, notwithstanding that some of the members might be trading ones, to be affiliated; but the advantages of affiliation would only accrue to those who were eligible to become members of the Institution.

Mr. PATERSON thought that, under these circumstances, the scheme was rather complicated than otherwise.

Mr. BELL asked, if the Council of the Institution did not adopt the suggestions of the Association, whether the scheme would fall through, or would it be referred back to the members for further consideration.

The PRESIDENT answered that the resolution they were passing that day was to the effect that they were willing to affiliate on the lines the Committee had stated, the actual details of which would come again before the Association.

Mr. PATERSON further observed that if they had had the scheme before them in writing or print, it would have been an easy matter for the members to have come to the meeting prepared to vote "aye" or "nay."

Mr. R. KING (Wolverton) remarked that they were not committing the Midland Association to any definite undertaking at all. The resolution before the meeting seemed to be that the recommendations which the Committee had submitted to them that day should be taken up by the President, Vice-President, and the immediate Past-President possibly, and considered in conjunction with the other local Associations. The members were not now committing themselves rigidly to anything. It was a simple thing which they could effect, and await the result.

Mr. S. MEUNIER (Stockport) said it seemed to him that what was here proposed was, on the face of it, rather going a little against affiliation, instead of for it. The idea that struck him, from what he had heard (he might be wrong), was that they were laying down certain terms to the parent Institution for a promise on the part of the Association to join with them. The same question had, of course, cropped up in other Associations. The matter had been before the Manchester Institution Committee, with the view of recommending to the members the lines on which they were prepared to affiliate. The Manchester Institution had not so far formulated any policy. They took the matter into consideration from the outpoint that it would be a benefit to the Associations to be affiliated with the parent body. At the same time, the difficulty was felt that, if they laid down any definite lines for their own Institution, it might likely affect the end they all wanted to get at—that was affiliation. He was divulging Committee business, perhaps; but it might assist the discussion a little, if he mentioned that the Manchester Institution Committee agreed to a resolution stating that they were perfectly prepared to entertain favourably the idea of affiliation, subject to the interests of the Manchester Institution itself not being affected, and also subject to its being an absolute benefit to the gas profession and the gas industry at large. Without laying down any definite lines or suggestions, it was felt that they ought to have from the parent Institution some sort of scheme which could be considered, and which could be voted upon. It appeared to him, from the President's remarks, that unless the suggestions of the Committee were carried, then the Midland

Association would not affiliate. [The PRESIDENT: Not at all.] That was the idea that struck him. He might be wrong; but he thought any idea of this kind would be very harmful. If affiliation was going to be a benefit to the gas industry generally, and not going to do any harm to the various District Associations, it was a very desirable thing to go in for. He, however, felt very strongly that they ought not to tie the hands of the Institution any more than compelled to safeguard their own interests; and that it would be preferable to have some sort of scheme before the members for consideration. They had got to this length, that the President of each Association for the time being should be *ex officio* a member of the Special Committee to deal with this question of affiliation. He (Mr. Meunier) thought that, for the present at any rate, this was as far as it was advisable to go; and it would, he thought, lead to the best results in future. As an amendment, he moved to the effect that the members of the Association were fully willing to entertain this question of affiliation with the parent body, subject to the interests of the Association being perfectly safeguarded, and subject, further, to its being a benefit to the gas industry at large.

Mr. J. T. LEWIS (Wellingborough) thought it was desirable the Association should be affiliated to the parent body. Perhaps, however, the suggestions as drafted were going a little further than was necessary that day. Personally, he thought it would be sufficient if they expressed the idea that it was desirable the Association should be affiliated with the Institution; but before the definite question came up for decision, they should have the lines put before them upon which affiliation could take place, so that they would really know what affiliation meant.

The PRESIDENT pointed out that the resolution he had proposed did not commit the Association to any lines whatever. It was merely composed of suggestions for the consideration of the Committee who had to discuss the matter. The Committee asked for an expression of the opinion as to the lines upon which the Association would affiliate; and the amendment suggested denied them that.

The amendment was then put and negatived; the resolution being carried by a large majority.

THE NEW PRESIDENT.

Mr. MEIKLEJOHN said his next duty was to introduce to the members the President for the ensuing year—Mr. George Helps, of Nuneaton. He sincerely hoped that Mr. Helps would have as happy a year before him as he (Mr. Meiklejohn) had experienced. He had pleasure in calling upon him to deliver his Address.

The PRESIDENT took the chair, and at once delivered his

INAUGURAL ADDRESS.

Gentlemen,—All general advances in any way noteworthy that have been made in our industry during the period since the last proud occupier of this or any other presidential chair connected with our Associations set out to review the progress in the manufacture and application of gas for light, heat, and power, will doubtless be chronicled in due course. On this occasion, therefore, I do not understand my duty to necessitate your being exasperated by a request—which could not very well be refused—to accompany me in that long, unrefreshing, and tedious journey from the retort to the consumer's burner. The honourable position which I now occupy by virtue of your most gracious and all too generous appreciation, is obviously not the outcome of an expectation on your part of my ability to give any special proof of knowledge of our art, but rather that I may take advantage of the opportunity which your Presidents always have, and expatiate with more than usual audacity on some crank, or otherwise give utterance extravagantly to impressions of some general practices with which I have forced myself into disagreement.

I purpose taking advantage of these privileges to the full; and I shall, therefore, probably trespass outside the pales of mutual accord, but not, I trust, beyond the limit of your good will and generous consideration. Some of you may hold that a President's Address should be confined to a recitation in the mildest possible form, of all the practices that are in general use, and with which, without reflection, nine-tenths of you would be pleased and in agreement. So many, I am afraid, will be disappointed. There is a true saying that "Ignorance begets confidence more often than knowledge does;" and doubtless many of you, before many minutes have elapsed, will be applying this moral to my utterances. Even so, I shall not be deterred from venturing an opinion on some points which will not coincide with your own, and which you will value accordingly; and it must not be forgotten that the maxim may possibly apply to the critic as much as to the person criticized.

Whatever the views, however, you now hold or will hold later, I do claim to take no second place so far as is concerned a desire to uphold with you the great industry of light, heat, and power which we all represent and have so much at heart.

In these days of free day and night schools, we hear continuously a cry for more technical education and general study; and the sequel to this is an increased and ever-increasing demand for more pleasures and excitements, while the opportunity, as well as the inclination, for healthy outdoor sport and bodily exercise grows daily less. We know very well that the present exigencies of life call for, or we think they do, all kinds of strains being put on the human capacity; and too often we are working or playing beyond the safe limit, if not dangerously near the breaking point. The tendency of our time is to carry things to excess, and to take life altogether more seriously than naturally; and so soon as this is the case, energy is wasted. In the training of our minds for work, and in our eagerness for new methods and up-to-date fashions, we are likely to crowd out, neglect, or overlook elementary truths of first or known principles, and the simple methods they unfold to us. I do not seek to put a premium on hyper-conservatism, which would conserve or hold any principle, good, bad, or indifferent, that it could lay its hand on, but on that conservatism which would retain old principles only so long as they are not fairly superseded.

Undoubtedly, the gas industry in no period of its history numbered among its workers and promoters so many scientific men or deep-thinking students. Those of us who do not come under the particular category we should like to, need not think that we have missed our vocation; for it happens so often—we may almost assume it is ordained so—that the man of research and study requires some light-hearted, rough-handed, and hard-headed assistant to put his laboratory practices into the, if rougher, more useful channels of ordinary everyday requirements. There is thus a demand for all of us so long as we are prepared to perform useful work; and there is such a thing as a man creating a demand for the particular knowledge he possesses. We do not want too many scientific men or students; and to watch that we do not get them, and to see that very little energy is wasted, it is well to occasionally overhaul our practices with a view to discovering the truth in respect of them, and in what measure the expenditure of mental or physical force has been lost by an insufficient exercise of the knowledge—previously acquired—of small things. This can be the better accomplished if we allow ourselves to be carried some distance away from our ordinary practice, and judge of the present known requirements more as a problem to be solved from knowledge of general principles, as far as possible removed from those deeply-cut grooves of method which depend solely on custom for their existence. It is known that knowledge, when properly assimilated, makes itself (by reflex action) the basis of all we do; and it follows that a little knowledge of this kind can be very prolific in its results. Unassimilated knowledge is like undigested food—it prevents the organs from carrying out their functions.

To emphasize important results, the obtaining of which are open to the most humble among us, let us consider the incandescent burner. It is not remarkable that, although the bunsen tube has been in use in conjunction with the Welsbach mantle for nearly twenty years, yet it is only now that so apparently simple a matter as the proper admixture of gas and air at the point of combustion, has received attention. We have all known for the time named that a mixture of gas and air was required; but not a man engaged in the industry for this period appears to have measured the air necessary, or experimented in this direction. Twenty years ago about 10 candles per foot of gas were obtained; now we can get 40 candles per foot. Imagine what the difference in duty between 10 and 40 candles per foot represents in value, and realize that there is not a man in this room, however poor an opinion he may have of himself, who would not admit that so simple a fact could have been discovered by him. Some claims have, I believe, been put forward for 60 or 70 candles per foot from 16-candle gas; but we have not yet seen such a result demonstrated, and it would appear that so far as gas lighting by means of mantles is concerned, the maximum of duty has been reached.

Another question, now that the exact mixture is known, and we are becoming familiar with the distribution of gas at high pressures, is how long will it be before we adopt some apparatus for mixing gas and air after the meter, so that the mixture can be caused to issue from a simple burner-head on any fitting without the intervention of an unsightly burner-tube, &c.

Having thus prefaced what I have yet to say, I will now endeavour to set before you, no matter how crudely, some thoughts on topics connected with the social and administrative practice in our industry to-day, and then follow on with a few facts and figures of the relative values of gas for light, heat, and power, compared with other agencies for similar purposes, and, in a rough way, point to a possible position of our industry in the near future, the greatness of which, to paraphraze Mr. Chamberlain, is measured not by comparison with its own past, but by its relative position, at the present time, with the other industries opposed to it.

I should like to express an opinion of the undoubted advantages of associating ourselves with gentlemen connected with allied industries or trades. In these days, as in all other days, no individual has ever gained any very useful knowledge by shutting himself up and cutting off communication with the outer world. We know that there is very much wickedness in the outer world, and of necessity so; but our cutting ourselves off from it does not improve the outer world or us. In fact, it is known that if an individual be kept to himself only sufficiently long, he will go mad. What is true of an individual is true of a collection of individuals, and of the Institution of Gas Engineers. In spite of all that can be said as to the benefits of our allowing various gentlemen with whom we do business to join our Associations, we seek to keep ourselves select; and if we only persist in this long enough, we shall be in the workhouse or the commercial madhouse.

When speaking of gentlemen connected with allied industries,

ambassadors solely of commerce are not necessarily alluded to; for it is true that the representative of a firm, unless he can claim some very particular knowledge of his line of trade, or some especial ability, could not be of the least technical use within our doors, no matter how good he might be, socially, outside of them. If it be known that certain practices are looked on with disfavour and discountenanced by those who should discountenance them, they will cease to be practised. Those members of this or any other Society, however few they may be, who meet but to recount all kinds of funny stories and partake of all kinds of mixed refreshments at no expense to themselves, are, generally speaking, no great acquisition in the discussion of technical subjects. They have their set and place among the animate objects of the Universe. Let them and the providers of their entertainments be kept within the pales their peculiar aptitude fixes for them.

Only recently, when on a visit to the North of England Association of Gas Managers, who welcome—perhaps some may think too readily—anyone who is prepared to pay the annual subscription, I met a gentleman connected with an allied industry and had some conversation with him, visited him, compared notes, and found that he was already working in certain directions I had in my mind to eventually work in. So that, instead of my staying at home and conning over ideas and speculating on their ultimate results in practice, and perhaps setting out to make certain experiments which must have extended over some years, I have been saved much head-work and trouble, by meeting a man of undoubted ability and capacity in the particular direction required.

It seems to me that all the precautions necessary to be taken in connection with the avoidance of impossible and unnecessary members, could be done by some such arrangement as the conferring of the degree of "Fellow" (for life, of course) of the Institution of Gas Engineers or other Association. Say a dozen—picked men all of them—were chosen for this honour, to whom would be left the responsibility of the nomination of any gentleman who wished to become a member of the Institution or Association? The method of election at present does not allow of any opportunity for exercising any care whatever. I would suggest that not only should the election of members of Associations or Institutions be in the hands of such "Fellows," but that any existing member could be called on to resign, if it were thought desirable, by a specified majority of the Fellows in meeting assembled. Some such an arrangement would, to my mind, enable the doors of all our Institutes to be open to the people they should be open to, for our benefit, their benefit, and the benefit of the commonweal.

In spite of the undoubted advantages that are to be derived from the reasonable intercourse of members of an Association like ours, it seems that not a tithe of the benefits are realized. For some reason, though most of us are willing to impart information as well as to receive it, very few ever care to be tackled with that persistence which it is generally necessary to exercise to obtain bed-rock facts. Too much information is given with too little tact. "The whole truth and nothing but the truth" should be our motto if we set out to impart information at all. We cannot all expect to be gifted with the same abilities and facilities for exercising them. Some of us may excel in various small directions, and be very far astray in others of, perhaps, great importance; and if it be only borne in mind that an exchange of ideas on various matters is only beneficial when wholly true, we should be less eager to make the questionable statements we are sometimes guilty of. One man cannot very well have the best experience in all the branches connected with any one industry. He must accept the experience of others sometimes.

Everything that can be done to increase our own knowledge and impart benefit in this direction to all who work with or under us, should surely be done. It is believed that in some works there are recreation-rooms which are used for technical education lectures by the works staff and others; and it is difficult for me to conceive how much better technical education can be obtained than in such a manner, particularly if, from time to time, professors from neighbouring colleges, and engineers and others from neighbouring works, known to possess especial knowledge on especial subjects, were invited to lecture. There is only one disadvantage, and that is that some of us would find it necessary to keep our knowledge a little more green than we do, so that our juniors would not be teaching us too much. But in most cases, even this objection could be evaded; for the chief could lecture just on those subjects he chose to do and on which he would know himself to be unassailable, and his assistants and the tradesmen and others could lecture on different subjects they were fitted to do, so that everyone, from the highest to the lowest, would at the same time have an opportunity of teaching as well as of being taught. We know that one cannot learn better than by setting out to teach others. Of course, we should have to guard against the blind leading the blind. There are many who cannot obtain any useful knowledge from a book alone; but bring the book to the work, and they are brilliant.

While on this subject, may I be allowed to point out, as many have done, how beneficial the reading of papers is, not only to the Association, but to the readers? I assert that there is not a man here who could not, if he wished, teach every one of us something. There is an idea that because a man is engaged on a small works, he is no good to a man who is engaged on a large one. The reverse is not infrequently the case; for small works in some ways have advantages. Our experiences cannot all lie in the same direction. We know "it is always safe to learn even from our enemies and seldom safe to teach even our friends." Because a man ventures to express his opinions, he should not be criticized for attempting to teach. It would be more often right to congratulate him on the lesson his expressions of opinion had taught him. They must be strange people indeed whose anxiety to teach surpasses their anxiety to learn. We should all try to do our little, as the Americans say—

> "Do what you can, be what you are,
> Shine like a glow-worm if not like a star,
> Be handy as a screw-jack if you cannot be a crane,
> A wheel-greaser may some day drive a train."

The Departmental Committee which is now discussing the various questions respecting the provision of gas for the Metropolis will doubtless examine those people whom such Committees generally examine—those people whom our industry holds in highest esteem; and if, among them, there be some who, on account of their confined lives, are unable to see the direction which modern gas supply must eventually take, it is to be hoped they will be in the minority. It sometimes seems that the mathematical position of works and men has more to do with their selection for examination than has technical ability, and that there are men of more varied, and possibly just as useful, experience who are never inquired for. London wants cheap gas; and to find out how to obtain it the Committee should look around and discover where the best methods are employed and the best results obtained. No man knows everything, and no one set of men. When a man is seeking the truth about a matter in which he is deeply interested, he would not act wisely if he were to look for advice from one who thought from the same poor vantage point as himself. He would do better to search out the man who, if he has not actually had experience of the accomplished fact, has certainly been further than he himself in the desired direction. People who think alike too often copy the same people. People who arrive at the same goal do not necessarily think alike, but they have the same interests and ideals, although they are looked at or approached from a different standpoint; and these are the people, surely, who make a good combination, socially and technically.

We have heard a good deal about the question of having at the disposal of a select number of engineers an experimental gas-works for research work. But nothing has been done; and it occurs to me that those of us who control small or medium-sized works might certainly arrange with our directors or committees, during six months of the year, to place our works sufficiently for the purpose required at the disposal of a Research Committee.

There are some things we can very well do without—Christmas boxes, firms or their representatives as shareholders, labour unions and associated manufacturers. I have known cases, and there are not a few, where firms purchase holdings in various gas companies for the express purpose of obtaining orders. The shares are either registered in the name of the firm, or perhaps more often in the representative's name, who, if not satisfied with the orders he receives, attends the shareholders' meeting and endeavours adversely to criticize the balance-sheet. This is a very insidious practice, and is a menace to the gas manager. I do not say for one moment that a firm has not a perfect right to invest its money where it pleases, so long as its object is not what I have indicated. The practice needs only to be known to be dealt with. Labour unions continue to act to the advantage of the lazy and the disadvantage of the diligent. Manufacturers still associate to keep up prices and retard progress. They agree among themselves not to sell under certain prices; and then immediately, where any large order is concerned, they stretch their consciences to the utmost limit to evade their associated obligations.

The question of salaries is of interest to most of us, and one cannot view with any satisfaction the present-day tendency to offer such paltry sums as we see from time to time are offered, where not only must it be borne in mind efficient men are sought for—men who have made themselves thoroughly proficient—but men of undoubted integrity. Some men may be paid more than they are worth, but there are more who are paid less than half their value.

There are some simple contrivances for gas-works use which to many of us appear to be of such known efficiency and proved economy that the inclination is to attribute their exclusion from our general practice at the present day to apathetic diffidence rather than to real distrust. Among these, I can name the following.

The steam-jet exhauster scarcely comes in the above category, but what rotary or reciprocating exhauster excels this in duty or economy?

Hydraulic Mains.—Dry mains were introduced as long ago as thirty years by our worthy Past-President, Mr. R. O. Paterson; but in spite of the many indisputable advantages of having nothing to impede the progress of the gas from the retort to the foul main, &c., works are to-day found using hydraulic mains having two, and perhaps three, inches of seal. In such cases as these, at a small estimate, 10 per cent. on the cost of the coal could be saved without any necessary reduction in illuminating power by the adoption of dry mains, or mains in which there is no seal during the time the gas is being evolved. Some people imagine that with an inch seal and an inch draw the advantage of a dry main is obtained as far as a free-way is concerned. They

forget that with oscillation there is an inch seal to be overcome for about half the time.

Choked Pipes.—For many years all kinds of contrivances have been thought of and experimented with in an endeavour to prevent the choking of ascension and bridge pipes. Gratings have been introduced into the mouthpieces to remedy the evil, the shapes of the pipes have been varied, &c., and water applied to the outside of the pipes to keep them cool. But the ascension and bridge pipes have not been increased to any extent in sectional area. Many works of some magnitude are to-day using ascension pipes of 3, 4, or 5 inches diameter. Why should they not be 10 or 12 inches, and so jointed that they could be readliy removed without causing burnt fingers and bad language?

Scurfing.—Carbon still accumulates in retorts, and by the use of scurfing bars is chipped off or removed, together with the walls of the retort. In ordinary practice, there should never be any necessity whatever for the use of a scurfing bar, the introduction of air to the retort doing all that is needful. There are many simple ways in which this can be done without any resort to machinery.

Retort Setting.—Far too many works are still using ordinary firing, instead of gaseous on the generative or regenerative principle; and in my opinion there are too many elaborate regenerators and too few simple generators in use. I still maintain that if the secondary air be heated to the necessary degree, it matters little whether it be done by what is called waste heat or by direct heat. Retort settings are ofttimes not allowed to do half the work of which they are capable. A bed that is properly set and well fired is, after three years' work, capable of repairs to an extent that will allow it to run on for another three years—seeing that it has settled and shrunk to its utmost limit. Retorts, of course, burn away; but there is no difficulty in having them constructed in the first instance so that they can be readily repaired. The chief point of failure is generally at or near the joint made between the retort and the cast-iron mouthpiece; but this trouble is quite removed by the use of cast-iron angle-caps fitted over the retort mouthpiece and built in the wall, so that the cast-iron mouthpieces can be secured to them. These caps are used in a few works; but their employment is not so general as it might be. Why brick retorts are not more generally in use is unaccountable. Where they are used, I am told there is nothing extraordinary in a service of about ten years, consisting of seven or eight working years. Let us compare this record with that of the best setting of machine-made retorts. Noteworthy examples of these settings are to be found at Cheltenham and Gloucester.

Then with regard to the distribution of gas. For years we have been distributing it at tenths of inches of pressure instead of at inches of pressure; and even to-day initial pressures of 10-10ths or 15-10ths are considered by some ample, and mains put down based on their capacity at such pressures. Mains could be more often laid during the summer at night. In large towns and cities, the upsetting of the streets brings many of us unnecessarily into ill repute.

I now pass on to matters of more importance. When we consider that the efficiency of gas to-day in high-pressure burners is 40 candles per cubic foot, or about thirteen times as much as flat-flame burners (thirteen times the duty means, for equal results, one thirteenth of the quantity), it points unmistakably to the immediate necessity of our finding new spheres of use for gas, or considerably increasing the use of it for known purposes; and we have to look about us and consider the direction from which the most important consumptions are to be expected, and whether a cheaper gas of low candle power but of high calorific power would not better suit the present-day requirements of our several towns and cities.

It would appear that when gas is very rich in hydrocarbons, &c., so much air is required for its complete combustion that the flame temperature is somewhat reduced, and, consequently, the illuminating effect to some extent. This was referred to by Dr. Colman, in his paper on "The Calorific Power of Coal Gas," in which he points out that it only requires about two-and-a-half volumes of air for the complete combustion of blue water gas, and that, consequently, the flame temperature is high. Again, the fact that a smaller burner can be used with a low-grade gas for a given illuminating power than is the case with a high-grade gas, is important. For instance, say that with 25-candle gas ten parts of air are required for complete combustion. A No. 4 Kern burner will only consume 3 feet of this gas, and give perhaps 100 candles—the burner would be taking 3 feet of gas and 30 feet of air, equal to 33 feet. A low-grade gas, requiring, say, four parts of air to one part of gas, could, therefore, be consumed at the rate of about 6¾ cubic feet; and if, say, only 23 candles per foot were obtained, we should have a light of about 150 candles. Again, in the former case there are products of combustion of 33 cubic feet of gas and air for every 100 candles of illuminating effect, and in the latter case the products of combustion would be no greater in volume, while the illuminating effect would be 50 per cent. more—say, 70 per cent. less air used up for the same light. The advantages of low-grade gas for cookers and fires must be apparent on these same grounds. Where gas is compressed, the higher the illuminating power the more hydrocarbons are liquified and lost.

Sir George Livesey, in May, 1900, read before the Institution of Gas Engineers a paper on "The Enrichment of Coal Gas," and gave most instructive diagrams showing the illuminating power in relation to illuminating effect with burner and mantle and also the calorific power. The diagram showed that with—

2-candle gas the illuminating effect with an incandescent burner and mantle (burner consuming 3·75 cubic feet per hour) was about				73·6 candles.
7-candle gas	,,	,,	,,	68·0 ,,
12·77-candle gas	,,	,,	,,	64·0 ,,

while the calorific power was between 550 and 600 B.T.U. The gas was specially reduced in illuminating power by stripping it of the hydrocarbons, &c.

The paper is a most interesting one; but whether Sir George Livesey is still prepared to aver that with gas of 6-candle power, consumed at the rate of 3·75 cubic feet per hour in a bunsen burner in contact with a mantle, he can obtain from it a higher illuminating effect than with 14-candle gas consumed at the same rate in the same burner (the air being adjusted to the gas in each case), I am unable to say. So far as my knowledge goes, the diagram has never been withdrawn. We can readily understand how these results were obtained, if the air supply was not adjusted to suit every particular quality of gas tested. But apart from any possible error of this kind, the main object of the paper has been proved and the fact amply demonstrated (see Appendix) that, in the gas supply of to-day, illuminating hydrocarbons are of very little importance, if not altogether unnecessary, and that our Acts, instead of requiring the gas we supply to be of a certain standard of illuminating power, should call for a specified number of heat units (B.T.U.'s) for every shilling to be charged per 1000 cubic feet. And thus there would be opened up to us illimitable possibilities as to the calorific agents to be employed, the methods of their preparation for distribution, and their uses when distributed.

We know that for economy of fuel—heat—the gas-engine is unrivalled; and we also know that for cleanliness and handiness the gas-cooker and gas-fire or heating-stove cannot be surpassed. Many improvements can be recorded in connection with the gas-engine during the last twenty-five years. We no longer talk of the explosive power of the mixture of gas and air in the cylinder, but of the expansive power of its combustion; and the gas required per brake horse power has been considerably reduced. The gas-cooker, in point of construction and duty, is very nearly all that can be desired; and it should be used in every household, summer and winter, wherever the price of gas permits. The gas-fire, on the other hand, beyond having been improved a little in appearance, is where it was twenty-five years ago in point of duty and application. Doubtless this matter will be put right so soon as gas authorities realize what a part the gas-fire has to play in the future.

At the present time, gas engines and fires, cookers, &c., take but a very small proportion of the gas consumed; and as it is generally admitted that, for power and heat, gas of some kind must be provided, it is our duty, as an industry working generally under special licence by Act of Parliament, and being responsible for vast sums of public money, to see that steps are taken to prevent any gaseous rival ousting us from our position. I for one do not agree that our best interests are served by our seeking to ignore the present or possible existence of rivals. I submit that the time for action has arrived, and that unless very definite action be taken we shall find ourselves with an Act of Parliament, and with gas-works and distributing mains for supplying an illuminating gas for which there is no demand. Let us look the matter in the face, and compare the values of other illuminants and sources of power and heat with our own commodity; for what chiefly concerns us is not the price at which we can supply coal gas per 1000 cubic feet at a profit, but—seeing that we are no longer monopolists—the price at which we have to supply it in open competition, either as motive energy or light energy.

1.—Gas power	with	Steam. / Mond and other producer gases.
2.—Gas-cookers . . .	,,	Coal or coke cooking ranges. / Steam.
3.—Gas fires and heaters .	,,	Coal and coke fires and heaters.
4.—Gaslight	,,	Electric light.

I have made the list in what I consider the order of respective importance—at least, so far as we in manufacturing centres are concerned.

Apart from other advantages, we know that power is chiefly a day load summer and winter. From the details given in the appendix we have:—

					Cub. Ft.
Mond gas of about 125 B.T.U. per foot will develop 1 B.H.P. with					77
Blue water gas of	240	,,	,,	,,	40
Coal gas of	600	,,	,,	,,	16

The cost per brake horse power at the following rates would be about:—

	d.
1.—Blue water gas at 5d. per 1000 cub. ft. would cost per B.H.P. .	0·200
2.—Mond gas at 4d. ,, ,, ,, . .	0·308
3.—Coal gas at 2s. ,, ,, ,, . .	0·384
4.—Steam costs, with coal of average quality and power equipment, and costing about 10s. per ton, medium-sized plant	0·500
5.—Electricity at 1d. per unit	0·900

There are plants for anthracite gas and bituminous gas for power, the fuel costs of which are extremely low; but, of course, with these plants the attention required, &c., approximates the

cost to that of steam for very large powers. Some of these plants might work out at about 0·3d. per brake horse power.

Engines are 15 to 25 per cent. dearer for Mond or blue water gas than for coal gas. Blue water gas is not suitable for engines.

Gas used in cookers to equal coal at 13s. 4d. per ton used in ranges must be sold at, say.	2s. 6d. per 1000 cubic feet.
Gas used in gas fires and heaters to compare with coal at 13s. 4d. per ton must be sold at, say	1s. 6d. ,, ,,
Gaslight, reckoning 22 candles per cubic foot, gas costing 4s. 10d. per 1000 feet	= Electricity at 1d. per unit.
High-pressure gaslight at 40 candles per cubic foot, gas costing 9s. 6d. per 1000 feet . .	= ,, ,,

In distributing gas and electricity—

	B.H.P.
An electric cable one mile long will cost £300, and deliver at its extremity an energy equivalent to (see Appendix)	44
A gas-main costing £300 will deliver an energy equivalent, at 25 lbs. pressure, to	2100

N.B.—It is only fair to state that if the cable were linked up it would perhaps deliver three times this energy.

How can electricity be generated and distributed more cheaply than by gas? The key, as it were, is in our hand to open the door to cheap power, and provide ourselves, if we will, with a controlling influence over electricity such as has never been dreamed of. As the late Mr. Denny Lane pointed out in his Inaugural Address to the Gas Institute in 1893, the only storage for electricity is in the gasholder; and he might almost have gone further, and said that the only means of distributing it was through the gas-main. What is to prevent our generating electricity on the premises of either electrical undertakings or private individuals?

During the past eighteen months, I have had the opportunity of testing gas of a calorific power of from 550 to 600 B.T.U., but of about 7-candle power (not a stripped gas), and the best result I can obtain is about 22-candle power per cubic foot at low pressures; no advantage being obtained at high pressure. By actual experiment, a 50-candle incandescent electric lamp consumed 6·6 units in 45½ hours; and 0·145 unit of electricity was found to equal 7⅓ cubic feet of gas consumed in an incandescent burner—1 unit of electricity being, therefore, equal to 17·25 cubic feet of gas. I do not claim that, because I failed to get a better result, no better can be obtained; but this comparison, in the absence of a better, will suit present requirements.

There are some considerations rather in favour of electricity for domestic purposes. It can be brought with such facility to the very point of use and just the power required only used; and it can be switched on and off with such facility that none is wasted. Again, if people only require simplicity, it can be almost as cheaply, and certainly more neatly, installed. This particularly applies to domestic purposes. The cost of fitting up 20 points of electricity would be 10s. per point, complete. It is certainly cleaner than gas; and I think the time will come when we need not lose our composure at its adoption for lighting purposes in residences. A small consumer of gas, using 10,000 cubic feet per annum before the adoption of incandescent burners, can have now considerably more light, and reduce his bill to about half its former proportions. Doubtless we might argue that more often than not the consumer will use about the same quantity of gas and have the increased light. But on these lines we are admitting that he is wasting light, for he cannot require such an increase; and then we come back to something like the fact that the difference in cost between the light required in electricity and more light than is required by gas is about equal.

Again, cannot we admit that in the case of the incandescent burners we have had to increase our expenses considerably on a less sale of gas? I refer to the necessity of keeping stocks of special fittings, mantles, &c., and to the fact that a fitter to whom we entrusted a flat-flame installation cannot be trusted to look after an incandescent installation. Then there is the cost of maintenance. Many undertakings do not charge any profit on this work; and we shall probably agree that the profit on the sale of mantles and other accessories is quite disproportionate to the extra trouble and expense of dealing in the articles concerned. Then, again, in incandescent public lighting, look at the extra labour entailed on which no profit whatever is made. Public lighting, and the lighting of factories and buildings, is likely to remain in the hands of gas for some time yet—gas being far more suitable for the purpose; and where high pressure is brought into use, it is ten times cheaper than electricity at 4d. per unit. We seem to think that we can trade in gas-fittings, stoves, and sundries *ad libitum*, and not require to make a profit beyond that realized on the sale of gas. This practice has, to my mind, reached its climax. We have heard for some time that the distribution of gas is more important than its manufacture. Should it be so? I repeat that with gas capable of performing a duty of 40 candles to the cubic foot, 1-13th of the gas for lighting purposes is required; and whatever arguments are brought, this fact must stand and face us sooner or later. Let us face it. There is nothing very alarming or dangerous in store for us. I have already argued, at far greater length than you have cared to listen to, that gas lighting cannot expect to keep the boards for ever, whereas gas for power, which includes heat, has no rival. I do not mean that coal gas has no rival. We know that there are several gases to be, or already being, manufactured for power purposes; and many undertakings will have to consider, shortly, the gas they can best supply.

Power is the citadel we have to capture! It is here shown that steam costs are more than gas-power costs when gas is at 2s. per 1000 cubic feet. But, as the saying is, "The devil we know is better than the devil we don't know;" and unless we can reduce gas to a figure very much below steam, we cannot expect to induce steam users to replace steam plant with gas plant. Gas reduced to something very near 1s. per 1000 cubic feet (600 B.T.U. per foot) will take all before it. It need not be an illuminating gas. There have already been advocates for selling illuminating gas for power at 1s. per 1000 cubic feet; but there is not one works that I know running on commercial lines that could afford to sell it at such a figure under existing conditions of manufacture and supply. No; before gas can be sold at the figure it will ere long be necessary for all of us to sell it at, our methods must be improved.

The vitals of our industry to-day are, as ever, chiefly within the pale of manufacture. If we can produce cheaply the gas that to-day is required, not the quality that used to be required—and we ought to be able to do so—we need never fear any outsiders taking our customers from us. If we can get away from the works that are immediately under our nose, and consider what the price of gas should be on the ordinary basis of present-day cost of plant, it should help us. For instance, we know that a gas-works to-day can be put down, exclusive of cost of site and exclusive of distributing mains, for £2 10s. per ton of coal carbonized. As figures for the cost of site and for mains vary to such a huge extent, these need not be considered. Sufficient margin can be left for them in the mind, remembering that high-pressure distribution halves the cost.

The manufacturing costs, then, at which gas should be made in an average sized works to-day obtaining results based as near as possible on the best that are obtained in an average works, can be readily figured out. Supposing the capital, exclusive of site and mains, is taken at £2 10s. per ton of coal carbonized (of course, where works have been properly depreciated in an ordinary case the capital should not exceed this sum very much, exclusive of goodwill), the capital charges should be 5 per cent. for depreciation (the time has passed for us to imagine that gas-works plant is never to be replaced by better plant, and that it has to remain until it is worn out), and 10 per cent. for interest. Now 15 per cent. on £2 10s. = 7s. 6d.; and if we reckon 10,000 cubic feet sold per ton of coal, we have a capital charge of 9d. per 1000 cubic feet. Coal costs 8d., less residuals. (In a number of works of various sizes it ranges from about 2d. to 1s. 3d. per 1000 cubic feet sold.) The cost per 1000 cubic feet sold, inclining to a low rather than a high charge per 1000 cubic feet, would figure out somewhat as follows:—

	s.	d.
Capital charges.	0	9
Coal (say)	0	8
Maintenance	0	2
Rates and taxes.	0	1½
Manufacture, wages, management, purification, salaries, &c. . . .	0	5
Miscellaneous	0	1
Total	2	2½ per 1000 c. ft. sold.

Here, then, is something like the price at which gas could be sold, allowing no capital charges for distribution or cost of site, but depreciating the capital as it should be depreciated on sound commercial principles, and making a profit that investors have a right to expect. We know already that we must look to gas-engines and gas-fires for maintaining our consumption; and knowing what Mond gas will do and what other producer gas in the indicated directions will do, it is to my mind perfectly clear that we have to find some method, and that pretty speedily, for reducing our manufacturing costs very considerably. Gas for motive and heating power will have to be sold at 1s. per 1000 cubic feet before many years; and it will be well to realize this fact. It is quite beyond my power of conception why gas companies with their works situated practically at the pit's mouth cannot find a means of supplying gas at one-third of the price some of them charge. Undoubtedly there is no better means of supplying power than that in the hands of our industry; and it is to be hoped it will not take twenty-five years for us to realize the fact. The steam-engine cannot give anything like the economy of the gas-engine; and the one thing that is keeping us back is the antiquated methods of our carbonization, the unscientific and uncommercial conduct of our distribution, and our tardiness of realizing that illuminating gas is supplied to-day more to comply with an Act of Parliament than because of any real demand that is made for it. What are these Acts costing the consumer, could he but understand it? Murdoch a hundred years ago carbonized coal in retorts almost as well as we do.

For the present gas industry to have anything like a secure position, in my opinion the costs of production must be reduced in the following directions: (1) Coal must not cost the sum it does per 1000 cubic feet. (2) Carbonizing costs must be reduced. (3) Distributing costs must be reduced. (4) Capital charges must come down.

(1) I have analyzed the accounts of the 38 gas undertakings given in "The Gas World Year Book" for 1903, and find that the coal alone varies from about 1s. to 2s. per 1000 cubic feet sold, and the cost of coal, less residuals, from 2·62d. to 15·19d. The prices charged for gas for power per 1000 cubic feet vary from 1s. 8d. to about 3s. 10d., with the exception of Widnes

in each case, where gas is sold as low as 1s. 1d., and where coal costs, per 1000 cubic feet sold, 12·058d., or with residuals allowed for, 0·63d. Next to Widnes in cheap production is Sheffield; and it does not want very deep thought to see why Sheffield, with coal costing 2·63d. per 1000 cubic feet sold, cannot sell gas at about 1s. per 1000 feet. Appendix J gives an idea of the general working of these places, based on one price for coal, &c. There are more ways than one of reducing the cost of coal per 1000 cubic feet, without cutting down the prices at the pit's mouth: (*a*) Utilizing that coal which lies nearest to us suitable for our purpose, and not increasing cost by unnecessary carriage. (*b*) Reducing the carriage of the coal and waggon hire, or carbonizing the coal at the pit's mouth, and delivering the gas to the works, after having washed and scrubbed it, under pressure of anything up to 100 lbs. per square inch.

Do we utilize the coals nearest to us to the best advantage? I have a map of the coalfields here from which it will be readily seen that we in the Midlands should have no reason to go to Yorkshire for our coals. Necessarily some collieries' expenses are more than others, and their costs at the pit's mouth vary; but this is a negligible quantity so far as the present consideration is concerned. The coals are not all of the same quality, and a high-quality coal will stand a higher rate than a low; but still there is some necessity to check these points from time to time. Improvements in many known cases can be made. Waggon hire and freight per ton I do not wish to say much about; but surely both these rates are quite high enough. When gas can be so economically enriched, there is not the same difference between Yorkshire and Staffordshire and Derbyshire coals.

The question of carbonizing coal at the pit's mouth has been talked of almost from the time of Murdoch; and while a good many of us believe that this is the right thing to do, no one sets about doing it. We know that the Mond Gas Company intend to take advantage of having large centres from which to distribute their gas. When the seriousness of this new Power Gas Company, who set themselves to supply gas at about 4d. per 1000 cubic feet, was not to be disputed, many of us wondered how they could distribute it economically. It did not occur to us that this is not a very big business if the moderate pressure of 40 lbs. per square inch is applied. [In passing, it is well to note that the Mond Company are not putting up gasholders, and that they do not desire customers of less than a million cubic feet per annum.] Water is distributed 20 miles, or any other distance, at pressures over 100 lbs. per square inch; and why not gas? We know water does not expand and gas does, and we also know what risks there are, and can set out to minimize them. Do not forget that when we travel we are often sitting over a gas-cylinder charged with gas at 100 lbs. per square inch. A comparatively small gas-main, something less than 18 inches in diameter, will deliver a million cubic feet per hour at a 10 mile extremity at this pressure; and where the carriage of the coal to make a million cubic feet costs for this distance £4 3s. 4d., delivery by compression would cost about £1.

As an example, take a busy centre where the make is about 7000 million cubic feet per annum and 700,000 tons of coal are used. If only 1s. per ton could be saved, it would mean £25,000 a year; and there is no reason why such a place should not save something like £50,000 a year on carriage alone, if within 10 miles of a gas-coal colliery. Were the matter seriously gone into, the laying of a gas-main of the required diameter is not like making a railway; and very little difficulty should be encountered in obtaining easements. Consider also the advantage of a main at high-pressure passing through the outlying districts. Would not factories soon spring up? There are many places conveniently situated with regard to coal. To spring from 10-10ths of an inch to 100 lbs. per square inch, is a bit of a jump, I will admit; but the difficulties have only to be thought out and faced to be overcome. Handle gas at 25 lbs. and then 50 lbs., and you will find the matter far more feasible than you will care to admit now.

Are we carbonizing coal when we do get it in our works in the most economical manner? Are we not all too much inclined to be constructional engineers rather than gas manufacturers? The selling price of gas should bear a little better proportion to the cost price of coal than it does. Cheltenham and Gloucester are miles away from collieries; and yet at the latter places gas could be sold at about 1s. 10d. per 1000 cubic feet for power. Let me refer to Appendix J. Compare the selling price of gas at works where the maximum labour-saving appliances are in use with works having the minimum of such. In 1896, the worthy founder of this Association, Mr. Charles Hunt, read a paper on the carbonizing of coal in ovens similar to those used for coke. Mr. Hunt gave the yield of gas per ton of dry slack as 11,398 cubic feet. This, to my mind, is surely a result in a test that called, and has been calling ever since, though it has not yet been heard, for further tests in this direction. If the application of a process similar to that used in connection with coke-ovens were adopted for carbonizing coal for gas, just consider the thousands of pounds such a process would save, together with its effect on the price of gas. This paper of Mr. Hunt's appeals to me as one of the most valuable that has been written on any matter in connection with a gas-works in recent years. Mr. Hunt has always undertaken so much, and done so much, that research work has necessarily been crowded out, or I am sure that no man could better have prosecuted investigations in the direction of coke-oven carbonization. It may be that I am wrong, and that Mr. Hunt or somebody else investigated this matter. If such be the case, I only hope that I may hear of it before I set to work to experiment in this direction myself.

Mr. Thomas Glover, also a Past-President, referred to the question in February, 1901, and showed plans of coke-ovens, and figured out what he considered to be the cost, and suggested the use of water gas for heating them. Later, Mr. F. P. Tarratt, the President of the North of England Association, referred to it, and called attention to a township being supplied with gas which was manufactured in coke-ovens.

When I first looked into the question of coke-ovens for carbonizing coal, from the experience I thought I had had in other directions, I made a note that carbonizing coal in those ovens may be the proper method for making coke, but not for making gas. This note was made chiefly from the idea which I always seem to have had in mind, and which, I think, many others have too, that the proper way to carbonize coal is in thin layers, so that you can get all the gas from it with little obstruction; and I have heard people say that there is no limit to the quantity of gas you can get from coal in this way if you are not particular about illuminating power. Of course, these people were forgetting all about fixed carbon, and that coal only contains so much volatile matter. Recently I have put into practice the carbonizing of thin layers of coal, with the result that I obtained no more gas than with a thicker layer. I did obtain, however, a gas of slightly better illuminating power. I am unable to say whether or not I made less tar, because I only conducted the test for twelve hours, with a view to obtaining the yield of gas and nothing else; so that the statement may be judged for what it is worth. I have since carbonized coal by filling up the retort, and the result per ton of coal has been almost as good as with small charges. So that, taking these facts in conjunction with figures I have obtained from places where they are using coke-ovens, and comparing them with those given by Mr. Hunt in the paper I have referred to, I am strongly of opinion that an adaptation of the coke-oven process for the carbonizing of coal will be found to be the most rational one for present-day requirements with many of us.

I need not go into the question as to how coke-ovens could be economically heated. We know something of heating retorts, I think, and it must be obvious that if we can satisfy ourselves that coal carbonized in this way will give a good yield of gas, even in 5-ton charges, to say nothing of 10 or 12 ton charges, we shall find that the process can be carried out for about half the capital cost and one-fourth of the carbonizing cost of any system at present in use in England or even in Europe. The cost of the erection of a retort-house, complete with coal breaking and elevating machinery, inclined retorts, and so on, to carbonize 100 tons per day, would be about £12,000; whereas the cost of coke-oven plant to do the same duty would be £6000, and the cost of carbonizing 6d. per ton, against 2s. in the former case, to say nothing of the extra plant to keep in repair, &c.

I cannot leave the question of carbonizing without mentioning the Settle-Padfield vertical retort. It has been tested at Exeter, and the working results most ably placed before us by Mr. Norton H. Humphrys. The results obtained are good, and are better than anything we have been accustomed to. But a process giving 13,000 cubic feet to the ton and no tar is not a cheaper one than that by which 12,000 cubic feet to the ton and the usual quantity of tar are obtained; and if the advantage in yield be attributable to the utilization of a body of heat contained in the incandescent coke already in the retort when the small charge of a few pounds is admitted, and so rapidly evolving the volatile constituents of the coal, I would ask what is to prevent an exactly similar process with the coke-oven. Again, we are told that this vertical retort is patented, and that the arrangement of charging is something quite new. I am the last in the world, I hope, to attempt to depreciate patents. I know full well what time, what money, and what anxiety are connected with the most insignificant practical application of new—or (the worst kind of all) supposed to be new—ideas; but, unless I am mistaken, I saw at Motherwell two or three years ago a similar arrangement for charging an installation of gas-producers. If not a similar arrangement, then I saw something which was equally applicable. And, further, vertical retorts have been used from the earliest days.

When I mentioned a make of 12,000 cubic feet to the ton, I had in my mind the results which are obtained at Scarborough by Mr. Alexander Allan. So impressed was I when I heard what he was doing, that I set out to see his works, and obtain the particulars from him on the spot; having sufficient presumption to think that if he made 12,000 cubic feet at Scarborough, I could make 12,000 cubic feet at Nuneaton, or know the reason why. I have satisfied myself that Mr. Allan is making this quantity of gas at Scarborough, and that before long I will make it at Nuneaton. Mr. Allan has nothing to hide. Of course, he has a dry main and a Lowe water-gas plant; and, of course, his gas is enriched. This is the secret of it, and it is one worth knowing; for his working results go to prove, I think, unmistakably that there is no cheaper carbonizing than his in this country. Mr. Allan's results are—

Half year to January, 1902	11,781	cubic feet
,, December, 1902	12,067	,,
,, June, 1903	12,270	,,
,, December, 1903	12,025	,,

I might mention that in June, 1902, he used for a considerable

portion of the time a 1-inch seal. Equalling these results, if the illuminating power be taken into consideration, are those obtained by Mr. Paterson at Cheltenham, where the average make of gas for thirteen years has been 11,147 cubic feet, 10,595 cubic feet actually paid for; the illuminating power being 16 candles—a truly splendid performance.

Mentioning this result brings me to what is known as the Lewes process. We all know that Mr. Sidney O. Stephenson read a very interesting paper on his carbonizing at Tipton last year; and although he uses what we have been accustomed to call a considerably inferior coal to Mr. Allan, his results approximate very nearly to the Scarborough figures. Mr. Stephenson does not, I think, claim to make per ton more than 12,000 cubic feet of about 13-candle gas, exclusive of the volume of blue water gas that he admits to the retorts. He seems to have satisfied himself, and I think he is right, that he does obtain an advantage from the admission of blue water gas; and in a rough way I attribute the advantage to this. He carbonizes, to my mind, at certainly a low temperature; and his gas without blue water gas would be rich in quality, and would be given off slowly, and if he did not admit blue water gas a lot of the benzols or light hydrocarbons, whatever they are called, would drop out. But the opinion I have formed is that if Mr. Stephenson carbonized his coal at a higher heat, he would get just the same make per ton without the admission of blue water gas as with it. Mr. Stephenson enriches, of course. The results at Cleethorpes are, again, very good, I am given to understand; and here they use blue water gas in much the same manner as Mr. Stephenson uses it. The results they obtain are, however, not over 12,000 cubic feet per ton of coal.

Whether the process has yet been applied in the manner Professor Lewes meant it to be, I know not; but we know from retort-house work that under certain conditions of working much more carbon is deposited in the retort than under others, and we know that ascension-pipes choke up sometimes most unaccountably, and that these deposits either in the retorts or ascension-pipes represent so much of the illuminating properties taken from the gas. This can be proved by our taking a small gas-retort, charging it with coke, and heating it up, and then passing coal gas through it, when it will be found that the gas on the outlet-side of the retort has considerably lost in illuminating power, and that carbon is deposited in the retort in the form of very fine powder. If, therefore, this deposit can be prevented by admitting blue water gas, the reason of the advantage would not be far to seek, nor the reason for no diminution in the tar and liquor, as claimed. Would it not assist matters if the blue water gas were conducted to the retorts while hot?

When carbonizing at high heats and with dry mains, very little carbon is deposited in the retorts and few ascension-pipes choke up. This is particularly marked. Mr. Stephenson has not tested his mixed gas for calorific power. It would be very helpful if a careful candle-power test were made as well. Mr. Allan, of Scarborough, I understand, is about to experiment with the process; and it will be most interesting to know his experience. The point we wish to discover is the difference between the calories in the coal gas unmixed and the calories in the mixed gas, less the necessary deductions for the calories contained in the blue water gas added. The two articles so excellently placed before us in the "JOURNAL OF GAS LIGHTING" of Feb. 9 and 16 on "Some Experiments on the Introduction of Water Gas into Coal-Gas Retorts" do not enable me to alter the opinion herein expressed. I am bound to bring in this question of the Lewes process, because a good many of us thought that we were going to get some gas for nothing; and the sooner we find out for ourselves whether it is a fallacy or not, the better for us and our undertakings. We cannot afford to miss any advantage.

Mentioning blue water gas reminds me of the two water-gas processes which are so much in evidence to-day. It seems to me that the two processes cannot be compared. Where, for some special reason or the other, it is desired to use it as is done at Tipton and Cleethorpes, or to decrease the quality of the coal gas and supply it at a decreased illuminating power, or enrich it by benzol as it leaves the works, the Dellwik process is the one to go in for; and where, on the other hand, it is desired to enrich the blue water gas with shale oil, and deliver and mix it in the holders containing coal gas, there is nothing like the Lowe process. What the heat units of a benzol-enriched gas of fixed proportions are in comparison with the heat units of carburetted water gas and coal gas in the same proportions, I do not know. It cannot be gainsaid that in the Lowe process heat units are consumed to heat up the carburettor, and in the Dellwik process you do not use heat units for the purpose. Consequently, in the latter process, you make more blue water gas per ton of coke than you make carburetted water gas per ton of coke. Appendix J would seem to show that water gas is not the most economical gas in the world. Where water gas and coal gas are manufactured, the practice is to include in the weight and cost of coal carbonized a quantity and amount which is supposed to represent the value in coal of the coke and oil used in the manufacture of water gas. Is there any good reason why the coke and oil should not be charged in the statement of account as coke and oil, and the corresponding quantity of gas made and registered by the water-gas meter shown also?

We now come to costs of distribution. I am inclined to contend that, while undoubtedly there was a time when services, meters, cookers, gas fires, burners, &c., should be supplied and maintained in the consumer's house free of cost, that time has passed, and that our whole-hearted object should now be to distribute gas only so far as the main is concerned, in order that the cost of the gas at that point may be reduced to the very lowest figure, and that other things should be paid for or hired. Only those managers who have had to deal with modern conditions as affecting consumers can begin to realize what a vast amount of money can be expended in running about after them, changing cookers, changing meters, cutting off services, &c., for which not only is no charge made, but the capital value of the works and distributing plant is affected, and so the cost of gas. We must all realize that when we supply slot consumers or ordinary consumers beyond the main we are increasing capital charges by services, meters, and so on; and more often than not these capital charges are increased quite out of proportion to the consumption. A tendency of the present day is to lay services, &c., free where there is often no necessity to do so. We should do well to consider the advisability of discontinuing doing work for nothing. It must put the cost of gas up and permanently increase the capital and its charges. Of course, we know the consumer cannot burn his candle at both ends. If he wants a free service, he has to pay the capital charges of the service in the price of his gas; and I maintain that it is to the consumer's advantage to pay for his service, so that the gas which he is daily using shall be sold to him at the cheapest possible rate. This, I think, must be obviously so; and the larger the consumer the more important is this fact to him. A power user will not hesitate to pay for his service if gas be cheap. Free work is a commercial fallacy, for it undoubtedly brings about the perpetuity of high charges for gas, and to the state of affairs which exists to-day—viz., that the selling price of gas is not in proportion to the cost of coal. (Refer to Appendix J for costs other than for coal.)

With regard to meters, they are too costly and too bulky for present-day requirements; and the Act of Parliament regulating the tests of them, cited as "An Act for Regulating the Sales of Gas, &c.," should be repealed. The day for supplying gas at a pressure of 5 10ths has gone. We require to-day a small meter with a great measuring capacity per hour, even if it takes a little pressure to work it.

We all know the advantages of high-pressure gas; and I suppose it will not be long before we test and overhaul our consumers' fittings, remove or alter water-slide pendants, test our existing mains, and supply gas at 10 or 20 inches pressure in those districts where at present it is supplied at about as many tenths. While this overhauling is in process, it will be well to remember that, having an eye to the future, the next pressure we shall begin to think about will be 10 or 20 lbs. There are few places, I suppose, where 10 or 20 inches could not be supplied economically. A fan or two and a gas-engine would be all the plant that was necessary. For cheap distribution, high pressure is imperative.

It may be expected that I should go into some particulars of the high-pressure system we have at Nuneaton; but this matter will be dealt with in more detail than I am able to give now in a special article or articles I am preparing for the "Gas World." I believe that the Directors of the Nuneaton Gas Company have the honour of being the first in this country or in Europe to adopt high-pressure distribution on lines somewhat similar to those followed in America. You may be interested to know that we have six miles of mains containing gas at anything up to 25 lbs. per square inch pressure, from which customers are supplied at 20 inches or 3 inches pressure. I cannot allude to this system without acknowledging my indebtedness to Mr. F. H. Shelton, of Philadelphia, who, it will be remembered, wrote a paper on the subject, which was read by him before the International Congress in Paris, and who has given me much information with every courtesy and goodwill. Mr. Shelton's work, which has been referred to from time to time in the "JOURNAL OF GAS LIGHTING" and the "Gas World," will, by name at least, be well known to you. By high-pressure the costs of gas distribution can be very considerably reduced. Of this fact there can be no question.

If, then, we set out to modify the Acts of Parliament under which we work to depose King Candle and set up King Calorie, buy the coal that is nearest at hand to put into our holders the greatest number of calories per ton at the least expense (always considering residuals), carbonize our coal at the pit or other most economical place, and in the simplest and most economical manner, then distribute the gas under as high a pressure as we can to the points that our consumers require it, and cease to incur expense beyond the main, we shall be able in a very short time to supply gas of 600 B.T.U. per cubic foot at 1s. per 1000 feet, draw larger salaries, have fewer worries, and bring about such an industry of light, heat, and power, and, in its train, such a cheap production of manufactures, that this Empire will flourish more than it has ever done before; and his most gracious and well-beloved Majesty the King will recognize our industry as one of the greatest in his dominions.

APPENDIX A.

POWER.

The selling price for 7200 B.H.P. hours, the power being developed by the Niagara Falls, is about $£4 = \frac{960}{7200} = 0{\cdot}133d.$ per B.H.P. This was referred to by Mr. Tarratt in his address.

We are also told, in "Cassier's Magazine," that the officers of the Power Construction Company reckoned that 24-hour steam horse-power is not developed anywhere in the world for less than £6 a year.

The same authorities state that in the production of steam power the cost of the fuel does not represent more than one-half of the total cost.

When we come to compare the cost of steam power we have a matter of much complexity to deal with. We know that with the very best equipment of engine and boiler, and assuming the same were working at full load for 24 hours per day for 300 days per year, 1½ lbs. of coal will develop a B.H.P. hour. But even so the cost of repairs and maintenance of engine and boiler, and the attention required, would be very considerably more than in the case of the gas-engine, and so soon as the plant is run for about nine hours a day only, as in general practice, the fuel consumption becomes about 6 lbs. of coal per B.H.P., and still there are the extra expenses of repairs, &c., and attention. In any comparison the difference in the capital expenditure on the steam plant and the gas plant must be considered.

	B.T.U.
1 lb. of coal, average quality	= 14,500
1½ lbs. of coal, average quality, is the best result ever obtained per B.H.P. in steam-engine	= 21,750
50 per cent. loss	= 10,875
Units per B.H.P., roughly	10,875
2½ lbs. is the average quantity of average coal used per B.H.P. in steam-engine	= 36,250
70 per cent. loss	= 25,375
	10,875

1 lb. of coal, at 1s. per ton, costs = 0·00535d.

	d.
With average quality (14,500 B.T.U. to lb.) coal, therefore, at 10s. per ton, the cost per B.H.P. for coal, with best possible boilers and machinery, is	0·0802
,, ,, coal at 15s. per ton	0·1203
,, ,, with average boiler and engine and coal at 10s. per ton	0·1337
,, ,, at 15s. per ton	0·2005

To include cost of driving, &c., all these figures must be more than doubled.

Efficiency of steam-engines as between I.H.P. and B.H.P. up to 100 B.H.P. plants	say, 80 per cent.
,, above 100 B.H.P. plants	85 and possibly 90 per cent.

We can afford to allow, for purposes of comparison with gas-engines, an efficiency of 90 per cent.

Allowing 90 per cent. efficiency, 1 I.H.P. = 1⅛ B.H.P.

Comparative Values of Converting Coal into Steam Power and Coal into Gas Power.

Allowing 2⅘ lbs. of coal per B.H.P. hour, 1 ton of steam coal at 10s. per ton will develop 1018 B.H.P. hours, leaving a residue of ash and clinker which is valueless.

The gas from a ton of gas coal, reckoning 12,000 cubic feet of 600 B.T.U., in a gas-engine will develop 820 B.H.P. hours.

2¾ lbs. of coal are here required to yield 14·75 cubic feet of gas, and equivalent of 1 B.H.P.

1018 − 820 = 198 B.H.P. hours.

The cost per B.H.P. hour with coal converted into gas = 0·1203d.

The amount, therefore, that has to be made up in the latter case is 198 B.H.P. at 0·1203d. = 23·819d., to do which we have a residue of—

10 cwt. of coke.
10 gallons of tar.
26 gallons of liquor.

The tar and liquor alone more than make up for the deficiency, so that we may reckon that with the gas-engine we are roughly 10 cwt. of coke to the good for every ton of coal that is used, compared with coal used in boilers.

From the figures on page 536 we have:—

1 unit of electricity = 17·25 × 22 = 379·5 candles emitted by incandescent mantle.

1 B.H.P. ,, say, 379·5 = ,,

Crossley's say that, with a full load (14·75 cubic feet) of gas in, their engines produce 1 B.H.P. of electricity; or, allowing for 3 per cent. belt losses and 94 per cent. efficiency = 9 per cent. 14·75 + 9 per cent. = 16·01 cubic feet per B.H.P. We may take it that a B.H.P. is developed at the engine with an expenditure of 16 cubic feet of 600 B.T.U. gas = 9600 B.T.U.

Probably the following figures, obtained on a practical test of six months, will give us a better idea of the average fuel used. These figures were obtained by me a little while ago.

APPENDIX B.

Fuel Cost per B.H.P. (Electric).

This is a short test under most favourable conditions.

Actual test at an electric works with smudge at 2s. 6d. per ton.

Coal used	726 lbs.
B.T.U. electricity generated	130
Coal used per B.T.U. generated	= 5·57 lbs.

$\frac{2240}{5{\cdot}57}$ = 402·1 B.T.U. per ton of coal at switchboard.

1 B.T.U. = 1⅛ B.H.P. ∴ 402·1 B.T.U. = 536·1 B.H.P. hour at switchboard.

536·1 B.H.P. hour from 1 ton of coal ∴ 1 B.H.P. = 4·1 lbs. coal.

Cost of coal per B.H.P. hour = 0·54d.

APPENDIX C.

Working Cost of Electric Power Plant.

Engine.—Built by Robey's, Limited, of Lincoln. Class E. tandem, compound condensing type, 19½ and 30 inch cylinders, having 40-inch stroke, of an I.H.P. of 350, at 90 revolutions per minute. Fly-wheel 16 feet diameter, grooved for cotton ropes. Steam pressure, 80 lbs. per square inch.

Electric Generator.—Built by the Electric Construction Company, Limited, of Wolverhampton. Their standard upright, bipolar type, capable of developing, as a normal continuous load, an output of 500 amperes at an E.M.F. of 500 volts, when running at a speed not exceeding 400 revolutions per minute. Carbon brushes. Self-oiling bearings.

Cost of Running the Plant Over a Period of Six Months Ending Feb. 4, 1903.

	£	s.	d.
Coal, smudge for one 30 feet by 8 feet Lancashire boiler, 1446 tons, at 1s. 6d.	108	9	0
Engine oil, 144 gallons, at 1s.	7	4	0
Cylinder oil, 108 gallons, at 1s.	5	8	0
Dynamo oil, 4 gallons, at 2s.	0	8	0
Cotton waste, 120 lbs., at 17s. 6d. per cwt.	0	18	9
Attendant's time	41	3	6
Firemen	41	3	6
Ash wheeler	32	8	0
Interest and depreciation on £3620 (capital) over a period of twenty years	136	10	0
	£373	12	9

At an E.M.F. of 500 volts and load of 400 amperes running nine hours per day for six days per week = 2,000 B.T.U. per day.

= 12,000 ,, ,, week.
= 312,000 ,, ,, six months.
= 416,000 B.H.P. hours.

1446 tons coal slack used = $\frac{1446 \times 2240}{416{,}000}$ = 7·78 lbs. per B.H P. hour.

Cost per B.H.P. hour = $\frac{£373\ 12\ 9}{416{,}000}$ = 0·215d. per B.H.P.

As no repairs and maintenance are allowed for, we may take the figure of £136 10s., and reckon that it covers 5 per cent. depreciation on £3620 = £93, and £43 10s. for repairs and sundries.

In this case, as you see, the coal is charged at the low rate of 1s. 6d. per ton. If the coal cost 10s. per ton, the cost per B.H.P. would have to be increased by $\frac{120 \times 9}{2240} - \frac{18 \times 9}{2240}$ = 0·41d.; and it would then be 0·215 + 0·41 = 0·62d. per B.H.P. hour.

In comparing this figure with the cost of gas per B.H.P. hour, we must not forget that here we have charged for depreciation of plant (engine and boiler, &c.), and attendant's time; so that the only deduction we can make from these figures is that a steam-developed B.H.P. hour, with an average plant, costs some trifle under a gas-developed B.H.P. hour, reckoning gas at 2s. per 1000 cubic feet and of 600 B.T.U., and coal at 10s. per ton.

Mr. Meunier some time ago (in October, 1902), in his paper "Gas and Electricity Departments in Combination," gave the costs of fuel from five different gas-works using coke dust alone or mixed with slack—surely the cheapest fuel that could be used. He does not give the price per ton at which it was charged, but the average per B.T.U. equals 0·46d. Now, if we allow 90 per cent. of efficiency for engine and dynamo, the fuel cost per B.H.P. will work out about 0·28d. This, again, would tend to prove that the before-mentioned figure (0·215d.) is not far wrong.

Another comparison we can take from the "Electrical Times" table of costs and records. Here the maximum load is not on so long as it would be in a factory working nine or ten hours a day; but it gives some idea of the cost. This figure works out, for the year ending March, 1902, at 0·60d. per B.H.P.; the highest being 1·68d., and the lowest 0·10d. We may therefore assume, until someone can place before us more reliable figures, that steam per B.H.P. hour is certainly not below about 0·3d., and that, considering the extra cost in working, &c., that gas at 2s. per 1000 cubic feet is equivalent to steam in an average of cases. But all these figures must be taken as but approximate. Messrs. Crossley are good enough to inform me that "with gas 600 B.T.U. at 1s. 6d. per 1000 cubic feet, no steam-engine of small or even moderate size could compete with a gas-engine."

APPENDIX D.

Gas-Cookers.

Rough Working Results.

With regard to gas consumed in cookers, 1 cubic foot of gas of 600 B.T.U. will raise 1 lb. of water 600° Fahr., or 4·2 lbs. air 600° Fahr. A pound of air at 40° = 12 5 cubic feet. One cubic foot of gas will therefore raise (12·5 × 4·2 × 600) 1° Fahr. = 31,500 cubic feet air.

Case A.—With coal used in a closed range under the control of mistress and maid, a rough practical test extending over six months showed that the cooking costs for three people, in addition to heating the kitchen, amounted to—

3 tons 5 cwt. of coal at 13s. 4d. = £2 3s. 4d.
Another six months, all the cooking being done for the same family in a gas-cooker, the costs amounted to 17,000 cubic feet of gas at 3s. 6d. = £2 19s. 6d.

The value of gas used in a cooker to compare with coal at 13s. 4d. per ton is therefore, say, 2s. 6d. per 1000 cubic feet.

Case B.—The oven or range having been heated to the cooking temperature, it took 14 lbs. of coal to cook a dinner for eight people, which, at 13s. 4d. per ton, cost 1d.

A similar dinner cooked in a gas-cooker, with gas at 3s. 6d. per 1000 cubic feet, took 40 cubic feet and cost 1$\frac{17}{20}$d. So that the price at which gas should be sold to compete with coal used for cooking, where the fire is not employed for heating the kitchen, would be something like 2s. 1d. This would be without considering the costs of obtaining the heat in the range oven to start with, or any difference in the discomfort and extra work attached to the use of coal.

We may therefore assume that gas at 2s. per 1000 cubic feet is equivalent to coal at 13s. 4d. per ton, apart from its saving of labour, &c.

APPENDIX E.

Gas-Fires.

Rough Working Results.

Case C.—Two coal-fires in two small rooms, about 12 feet square, consume, at the rate of 65 cwt. of coal in six months:—

3 tons 5 cwt. at 13s. 4d. = £2 3s. 4d.

To heat the same room for six months, two fires, consuming about 25 cubic feet per hour, were used.

2 × 25 × 12 × 182 = 54,600 at 3s. 6d. = £19 2s. 2d.

Gas to be equal in cost to coal, and to give about the same heating power, would have to be sold at $\frac{520}{54{\cdot}5}$ = 9½d. per 1000 cubic feet.

However, the saving in work is to be considered, and the fact that a gas-fire need be used only as it is required. There are many cases, of course, where it would have an increased value—for instance, when a fire is only required for an hour or two per day for occasional rooms and offices, &c. We may, therefore, assume that gas in fires is worth at least 1s. 6d. per 1000 cubic feet to compare favourably with coal continuously used and valued at 13s. 4d. per ton.

APPENDIX F.

We now come to gas light and incandescent electric light. As before stated:—

1 unit of electricity . . . = { 17·25 cubic feet of 600 B.T.U. consumed in an incandescent gas-burner, and giving 22 candles per cubic foot.

Total illuminating effect of 1 unit of electricity . . = { 17·25 × 22 = 379½ candles, say, 380 candles for one hour.

1000 cubic feet of gas . . = { 22,000-candle power for one hour, or 57·89 B.T.U.

The ratio of value between 1 B.T.U. and 1000 cubic feet of this quality of gas is, therefore. 1 : 57·89, or, say, as 1 : 58. Or, in other words, if a unit of electricity costs 1d., 1000 cubic feet of this gas is worth 58d. = 4s. 10d.

N.B.—22 candles per foot is a very fair average to take for 16-candle gas. Of course, where high pressure is concerned, the advantages are doubled in favour of gas. And if electricity be sold at 4d. per unit and gas at 4s. 10d., gas is four times the value of electricity, light for light.

APPENDIX G.

Distribution of Electricity.—The loss in transmission increases inversely as the square of the increase in volume.

Cost of 0·1 square in cross section in three sections, and measuring about 1¼ inches diameter for 1 mile . . . . . = £192
Laying 112

£304

This cable will distribute at its extremity 100 amperes at 440 volts = 44 units = say, 58 brake horse power. If linked up, it would deliver three times the energy.

A gas-main costing £300 per mile laid would be represented by, say, a 3-inch diameter main, which has a capacity of 35,000 cubic feet per hour at 25 lbs. pressure = a duty of 2100 brake horse power.

A 1¼-inch gas-pipe corresponding in dimensions to a 1¼-inch cable would, at 25 lbs. pressure, deliver about 2000 cubic feet = 125 brake horse power.

APPENDIX H.

Sir George Livesey's diagram shows:—

Tests of "Stripped" Gas.

Gas of	6	candles	577	gross B.T.U.,	or per candle	96	B.T.U.
,,	7·5	,,	585	,,	,,	78	,,
,,	12	,,	600	,,	,,	50	,,

Mr. Newbigging, of Manchester:—

Ordinary Gas.

Gas of	17·30	candles	165·12	calories,	or	9·54	calories per candle.
,,	16·75	,,	162·28	,,		9·68	,, ,,
,,	16·55	,,	164·98	,,		9·96	,, ,,
,,	15·47	,,	163·04	,,		10·54	,, ,,
,,	14·90	,,	158·38	,,		10·63	,, ,,
,,	13·95	,,	156·09	,,		11·19	,, ,,
,,	13·02	,,	154·13	,,		11·83	,, ,,

73·37

10·48 average calories per candle for 13 to 17 candle gas.

Dr. Colman:—

Ordinary coal gas of	17 to 20	candle power gave	average gross calorific value of	161·3 or 9·33	per ft.
,, ,,	16 to 17½	,,	,,	158·4 or 9·51	,,
,, ,,	16 to 18·2	,,	,,	158·9 or 9·18	,,
Cannel gas of	22·89 to 33·3	,,	,,	234·4 or 8·17	,,
Car. water gas of	16·80 to 19	,,	,,	142·5 or 8·16	,,

44·35 ÷ 5
= 8·87 calories per candle.

8·87 calories = 35·21 B.T.U. for gas of 16 to 22·89 candle power.

Mr. T. Glover, of West Bromwich, in his Presidential Address, said:—

Gas of	5·97	candles	gave	583·78	B.T.U.,	or per foot	97·78 B.T.U.
,,	13·12	,,		587·40	,,	,,	44·77 ,,

Nuneaton tests, low-grade gas not "stripped":—

Poor coal gas of 7·4 candles gave 142·8 gross calories, or 19·3 calories per foot, equal to 76·62 B.T.U. per foot.

(Average of four tests.)

APPENDIX I.

Possible Costs, &c., of 25-Candle Power Gas Compared with Blue Water Gas.

Cost into Holder.

If 25-candle gas contains, say, 212 calories per cubic foot,
,, ,, ,, costs 8·75d. per 1000 cubic feet sold, then 24,228 calories are produced for 1d.

Then blue water gas of 260 calories to equal 25-candle power coal gas in calorific value must be made for . . . . . 2·48d. per 1000 cubic feet.

There could, therefore, be no advantage in mixing blue water gas with 25-candle power gas.

Power gas of 135 calories per cubic foot must be made to equal 25-candle power gas, costing 8·75d. per 1000 cubic feet, for . . . . . 5·57d. per 1000 cubic feet

If, with 25-candle gas, 24,228 B.T.U. can be made for 1d., 1 brake horse power can be developed for $\frac{9600}{24{,}228}$ = ... 0·396d.

Cubic feet of 25-candle gas required per brake horse power = $\frac{9600}{841}$ = ... 11·4 cubic feet.

APPENDIX J.

Name of Town.	Cost of Coal per 1000 Cubic Feet Sold.	Coal, less Residuals, per 1000 Cubic Feet Sold.	Gas, Selling Price.	Costs other than Coal.	Coal at 14s. per Ton. Costs per 1000 Cubic Feet Sold.	Gas Could be Sold at per 1000.
	d.	d.	d.	d.	d.	d.
Widnes	12·058	0·631	21	16·77	16·800	29·25
Sheffield	12·290	2·626	24	21·93	,,	32·80
Wigan	14·509	5·325	36	20·11	,,	41·71
Colne	14·845	6·007	36	24·15	,,	40·86
South Metropolitan	16·002	5·339	27	23·9	,,	28·35
Todmorden	16·505	8·660	38	24·25	,,	38·69
Leicester	16·529	7·752	38	20·34	,,	38·63
Bolton	16·602	7·494	38	17·9	,,	38·60
Bradford	16·634	8·707	40	19·8	,,	40·48
Salford	16·775	8·246	34	19·9	,,	34·20
Nottingham	16·909	8·176	34	24·1	,,	33·79
Newcastle and Gateshead	16·960	7·027	48	18·41	,,	47·71
Commercial	17·044	8·917	32	23·9	,,	31·62
Stafford	17·175	8·956	46	21·57	,,	45·19
Manchester	17·446	11·610	36	18·42	,,	34·7
Scarborough	17·546	10·014	44	27·45	,,	42·2
Stoke-on-Trent	17·838	9·252	44	22·97	,,	41·5
Croydon	17·888	8·921	43	27·86	,,	40·5
Gaslight and Coke Co.	17·893	8·599	41	30·1	,,	38·7
Brighton and Hove	17·899	10·687	51	29·74	,,	48·1
Tottenham	17·956	12·304	40	27·61	,,	37·5
Edinburgh and Leith	17·993	13·161	40	26·33	,,	37·5
Blackburn	18·144	10·756	42	29·06	,,	38·9
Heywood	18·222	9·928	36	24·71	,,	33·2
Glasgow	18·388	11·226	30	15·73	,,	27·4
Oldham	18·449	12·335	30	16·68	,,	27·3
Bristol	18·627	8·938	27	20·45	,,	24·3
Crystal Palace District	18·857	9·845	31	22·88	,,	27·7
Lancaster	18·955	6·741	30	18·5	,,	26·6
Brentford	19·237	11·983	35	26·27	,,	30·6
West Bromwich	19·401	10·236	40	20·15	,,	34·6
Dundee	19·905	14·030	40	24·49	,,	33·7
Nuneaton	20·720	11·400	42	30·3	,,	34·08
Bromley	21·887	9·199	37	30·58	,,	28·5
Carlisle	21·921	14·621	27	14·96	,,	20·7
Harrow and Stanmore	22·741	15·307	54	39·13	,,	40·0
Barnet	23·661	10·557	48	..	,,	34·1
Dublin	23·750	15·756	59	31·28	,,	41·8
Hastings	24·153	15·193	36	25·0	,,	25·69

Column 6 shows the price at which gas could be sold, based on the cost of coal being common to all at 14s. per ton, and 10,000 cubic feet per ton being available for sale, and on the proportion that the actual selling price (column 3) now bears to the different cost of coal in column 1.

Mr. Charles Hunt (London) said he had very great pleasure in proposing a vote of thanks to the President. It was few, if any of them, who had the wealth of language, or the sense of humour, or the facility for imparting truth in such happy phrase, as the President had. He had listened to the address with the utmost pleasure, as he was sure the members all had. There was in it a great deal that he (Mr. Hunt) could heartily agree with, especially with the remarks upon the future of their industry in connection with low-grade gas. He hoped Mr. Helps would continue his researches in this direction, and that the members might have the benefit of them. It only remained for him to thank the President for his kind references to himself (Mr. Hunt). The matter to which he referred was one which appeared now to be of almost academic interest. But some day or other, it might revive; and those who wished it well he thought would find that their belief in its possibilities would not be disappointed.

Mr. R. O. Paterson (Cheltenham), in seconding, said he must agree that their President had not disappointed them in their expectations of a really racy, learned, and altogether encouraging address.

The motion was enthusiastically carried.

The President said it was extremely encouraging to him to have the members receive his efforts as they had done, and to favour him with such consideration. He very highly appreciated the fact that so many had come to the meeting that day.

Mr. S. O. Stephenson (Tipton) read the following paper, on

GAS-FIRES.

While the gas-cooker has advanced until it is now very near perfection, if not quite at that stage, it is admitted on all hands, even by the makers themselves, that the gas-fire is very far from perfection. Gas should be the most popular fuel, for it has many advantages over solid fuel. It is convenient and clean; it is the very essence of the coal. The fire is always there, and can be lighted without trouble immediately it is wanted and turned out as soon as done with—thus saving expense. There is no mess to clear up; and the exact amount of heat required can be supplied and maintained by merely turning a tap. And yet the gas-fire is undoubtedly not popular. Why? It can very safely be said that few people adopt gas-fires because they prefer them to coal-fires. With such advantages, one would expect the preference to be given to the gas-fire, even in face of higher cost, to a far greater extent than at present obtains.

It cannot be denied, of course, that one great obstacle to their general adoption is the question of expense. Generally speaking, for a fire in constant use, gas is double the cost of coal or coke, even under favourable conditions—thus placing its use for the heating of general living rooms out of court. But it is very questionable whether, if the cost were no greater, the gas-fire, as at present constituted, would displace the coal-fire. Gas-fires are chiefly in use in offices, especially city offices, bedrooms, reception, and drawing rooms. In all these cases, the reason for the use of the gas-fire is purely that of convenience; and it is quite certain that, considering its great convenience for these purposes, it is not adopted even in this direction to anything like the extent it might be were it more attractive. The question of cost is not the only objection to the gas-fire. How many gas managers, whose gas is free, have their general living room heated by a gas-fire? I fear very few.

One would naturally expect that the ladies, who frequently in these days have the experience of being without servants, would welcome the gas-fire as a boon. But this is undoubtedly not so; and they will willingly put up with all the dirt, trouble, and inconvenience of a coal-fire in preference to what they term the discomfort or want of comfort of a gas-fire, remarking "I want none of your nasty gas-fires, let me have a coal-fire"—a sentiment cordially echoed by the head of the household. A similar expression of feeling was made recently by Sir Joseph Dimsdale before a Royal Commission in response to the suggestion that gas should entirely replace coal for heating in London. This objection to the gas-fire may be put down to prejudice. If so, then how is it that gas-cookers are being universally welcomed into so many households, are increasing in popularity, and in many instances are now depended upon for the whole of the cooking? It is not altogether prejudice; there is something wanting in the gas-fire itself. I have had the pleasure of visiting a gentleman connected with the gas-stove industry, and have found him seated cheerfully by the side of a good coal-fire, which is certainly a case of finding Saul among the Prophets.

The general opinion may be summed up in the words of one of my consumers, who said: "I want a good gas-fire if you have one, something as good as a coal-fire. I don't mind the expense; but your average gas-fire is abominably ugly and abominably cheerless." He selected a log fire, which, he says, is very cheerful, though the gas bills are a bit high. However, his general summing up of gas-fires about hits the mark. They are neither particularly pretty nor very cheerful. As fires, there is an air of unreality about them which is suggestive of "a painted ship upon a painted ocean." You may have a very nice grate. The fitter comes along and sticks a nasty ugly piece of sheet iron in front of it, so that its beauty may not dazzle the eye or compete with that of the gas-fire, which is stuck like a dab of putty in front of, and at the bottom of, the iron sheet. You then see, in addition to the plate, a few tiles, a little filigree work, and about 6 square inches of fuel heated to redness, but which, lest it should be too much exposed to view, is more or less hidden by a canopy which comes down on top of the fire. This fire heats the room fairly well perhaps; but as a test of its attractiveness, you have only to come in on a cold, miserable, slushy day, and have one room heated with this gas-fire and another with a coal-fire. You will instinctively draw near to the coal-fire, feeling that there is more comfort to be extracted from it.

I think this is a matter of great importance to us; and we should try to find what is wanting to make a gas-fire as cheerful and attractive as a coal-fire. It is with the view that a discussion of the subject by the Midland Association may point the way to the makers that I have prepared this paper, rather than the possession of any ideas of my own for improvement. That the makers are doing their best is instanced by the numbers of new patterns constantly being brought out. The first gas-fire consisted, I believe, of a burner placed in the grate which was filled up with fire-clay lumps. After that came Leoni's asbestos fibre fire, followed by fires in which iron grids were heated by the gas, and fires having a combination of iron grids, platinum wire, and asbestos. These were all discarded for the type of gas-fire in general use to-day, consisting of a shallow bed of shell fuel heated by the gas, with a canopy coming closely over the top of the fire and fitted with hot-air chambers. At the present moment, there appears a disposition to go back to the original plan of setting the fire in the coal-grate; and that the makers are quite aware of this disposition is evidenced by the fact that many of them are making a fire basket which can be placed in the grate without any trouble and merely requires connecting up.

And now let us consider the principal objections raised against the gas-fire. I think they may be summarized as follows:—

1.—Its cheerless and unattractive appearance.
2.—The stuffiness and apparent dryness it imparts to the air of a room.
3.—Its danger, particularly for bedroom use, in the event of lighting-back.
4.—It cannot be poked.
5.—It is not so convenient for burning letters, papers, and other rubbish.

The last two objections are of a frivolous nature, and would not be seriously entertained with a perfect and attractive gas-fire. Other arrangements might be made for the amusement of poking, and for the destruction of papers by fire. The fact of the canopy coming down so close on the top of the fire, and the apparent lack of depth, have much, in my opinion, to do with the first objection—the consumer feeling that he is not getting much for his money. Then I think the fire is in many instances too close to the ground, looking better when raised on a tray. Fitters also, in the majority of cases, show a lack of initiative and originality in setting a gas-fire. Their sole idea seems to be to place a wrought-iron plate in front of the existing grate, and the gas-fire in front of that—the flue-pipe passing through the plate; whereas in many cases a few slight alterations will allow of the fire fitting in with the grate and giving a much better appearance.

With regard to the second objection, one frequently hears the statement that a gas-fire makes the air of a room dry; and to obviate this, pans of water are placed in front of the fire for the water to evaporate and counteract the alleged dryness, with the result that the air of the room becomes charged with an excessive quantity of moisture, which condenses on to the walls and elsewhere—without, however, preventing the dryness which is usually experienced in the throat. Now the late Mr. Thomas Fletcher demonstrated, after several experiments, with a gas-fire burning, that there was no appreciable difference in the percentage of moisture present in the atmosphere of the room, and that the sensation of dryness was really caused by carbon monoxide given off by the fire; and, as our President says, "every little bit of sulphur helps." Indeed, one fails to see why a gas-fire should dry the air more than a coal-fire. I have a paper by me written by a Dublin Doctor a few years ago, in which he mooted the idea of introducing water in a finely-divided state through asbestos fibre into the fire, which, he stated, counteracted the dryness and gave to the fire a cheerful glow. I tried the experiment, but failed to achieve the results he claimed.

Another possible cause of the stuffiness is the heated-air arrangements. It is generally recognized that the method of heating rooms by hot air, as, for instance, with steam and hot-water pipes, is not a very satisfactory one; and it is accompanied by a distinct and somewhat unpleasant odour. Another, and, I think, very important, cause of the stuffiness is that with our usual method of fixing a gas-fire, by blocking up the grate with a piece of sheet iron, we are closing off a large part of the room's ventilation. A chimney is a splendid ventilator; and with a coal-fire going, the air of the room is kept fresh—the bad air being drawn away up the chimney all the while. When a gas-fire is put in, this ventilating space is reduced to that of the flue pipe—from 2½ to 3 inches in diameter. This must affect the ventilation.

After studying all these points, I am inclined to the opinion that the earlier form of gas-fire set in the coal grate, or its alternative, the fire basket, is preferable in many ways. It assists rather than obstructs the ventilation of the room; there is not so much likehood of its giving off impurities into the room; and it has a more cheerful and substantial appearance, looking more like a coal-fire. It is generally considered that this is an uneconomical, and, in fact, a wasteful, method of gas heating; but I think that, for the increased comfort and better ventilation, we can afford to lose a little efficiency. Moreover, if the grate be set in an intelligent manner, there will be found little less efficiency than with the ordinary gas-fire. I had a gas-fire of good and reliable make, and good as gas-fires go, in a room in my own house; the fire-place being blocked off as usual with the sheet of iron. I noticed that after the fire had been alight for an hour-and-a-half or two hours, the air of the room always got dry and stuffy. I removed the iron sheet, took the burner out of the fire, and set it in the grate. The result has been entirely satisfactory. The room is comfortably heated, with no trace of dryness or stuffiness, the fire looks nice and cheerful, and no more gas is used.

One often hears it said that a gas-fire set in a coal-grate wastes a lot of gas and gives very little heat. In many cases I think the statement is justified; but it is owing to a want of intelligence in setting. The usual plan is to fix the burner in the grate and fill in with shell fuel to a depth of about 3 inches, with the result that the blue flames of the gas show through the fuel, and most of the heat is dissipated up the chimney. The best method, to my mind, is to place the burner in the grate as close to the bars as possible and fill in with fire-bricks or tiles and clay to within 2 inches of the bars. There is then just room for one piece of shell fuel between; and it maintains this thickness up to a height of 4½ inches. The tops of the fire-bricks are sloped off with clay;

and this is covered with a good supply of shell fuel. The waste gases have thus to pass through a quantity of fuel before reaching the chimney; the greater part of their heat being taken up by it and radiated into the room. The bricks also prevent the heat being dissipated in the back of the grate, and the front, becoming red hot, acts as a powerful radiator. In the case of my own fire, I have found very little heat going up the chimney; and I have the same burner, the same tap, and the same connection as in the old gas-fire using the same quantity of gas.

With regard to the danger from lighting-back, the burners of gas-fires are so well constructed that this mishap does not frequently occur, and serious results are fortunately rare. But the possibility is nevertheless there; and there have been, I think, two instances recently of poisoning from this cause, which ended fatally—the gas-fire in each case being in the bedroom, one of the victims being the founder of the Polytechnic Institute, London. In both cases, I believe, the ventilation of the rooms was bad, and neither the gas-fires nor their arrangement were of the best. It is doubtful, had it been otherwise, if these fatalities would have occurred. But these cases, rare as they are, were quite sufficient to cause a scare against gas-fires; and it is a scare we cannot well blame, for it is a serious matter, especially where the heating of a bedroom is concerned.

I must, however, in justice, mention one fire which is not subject to this defect of lighting-back. I refer to the Kern radiator. I have put it to some severe tests; but have failed to get it to light-back. Neither have I been able to find any carbon monoxide among its waste gases. These two points are of the highest importance; and for this reason alone, apart from its other advantages, I unhesitatingly recommend the Kern radiator for the heating of bedrooms. It makes a good and most suitable fire for the heating of any room; but for bedrooms, on account of its safety, it stands alone. It is rather out of the regular line; but it is to my mind the most perfect gas-fire we have on the market at the present time. It is pretty in appearance, has good heating powers, and there is perfect combustion of the gas. It is therefore economical (the full heating value of the gas being obtained); and there is no emission of carbon monoxide. A fire then, such as the Kern, which cannot light back and will not give off any carbon monoxide into the air of the room (which, in a bedroom needs to be as pure as possible), must surely be the one fire to recommend for bedroom use, especially when we recollect that a fire for this purpose is frequently for the benefit of an invalid. The first Kern fire I had possessed one serious disadvantage. It would roar at times; and whether the burner were turned high or low, the roaring would not stop. This defect has now been remedied; a small attachment by the tap allowing of the gas and air admixture being adjusted to a nicety, so that the fire burns quietly.

I have had several fires in my show-room tested, and append tests of four of them, which I have taken as being fairly representative:—

Ordinary Gas-Fires.

	No. 1.	No. 2.	Fire Basket.	Kern Radiator.
Temperature of the room at starting	48° F.	54° F.	45° F.	53° F.
Maximum temperature to which room was raised	69° F.	68° F.	63° F.	68° F.
Temperature raised	21° F.	14° F.	18° F.	15° F.
Time taken to attain maximum temperature. .	2 hrs. 15 min.	1 hr. 20 min.	1 hr. 40 min.	1 hr. 30 min.
Gas consumption.	68·5 cu. ft.	42 cu. ft.	48 cu. ft.	34 cu. ft.
Gas consumption per hour . . .	30·4 ,,	32·3 ,,	28·9 ,,	22·7 ,,
CO in waste gases	0·3 per cent.	0·5 per cent.	0·2 per cent.	Nil.

I have not touched upon radiators, condensing stoves, &c., as they are designed for special purposes, such as the heating of passages, small studies, &c., rather than for heating ordinary rooms, and are therefore outside the scope of this paper.

I would just like, however, to touch upon a side-issue. In the majority of hotels in our small and medium-sized towns a candle is the only light given to a visitor for the bedroom; and if a fire is required, there is trouble and expense about the matter which the usual visitor does not care to incur. Now there is a source of profit at the hand of the landlord, with the outlay of a very little capital and no trouble, which it has often been a mystery to me he has not seized upon. Let him provide in each bedroom a shilling slot meter, to give (say) 100 cubic feet of gas for 1s., a gas-fire and a gas-bracket over the dressing-table, and a small, prominent notice to the effect that the visitor, by placing 1s. in the slot, could obtain the use of the fire and gaslight. I feel quite sure that the advantage would be readily seized upon during the winter months by many visitors, and the landlord would get a handsome return on his capital. For 1s. the visitor would get the advantage of a good light to undress and possibly shave by, and a good fire for an hour-and-a-half at night, and again in the morning to dress by. I firmly believe that such a piece of enterprise on the part of the landlord would be welcomed and turned to good account by his guests. It would mean an outlay of £4 to £5 per room; but a trial could be made upon two rooms, and extended afterwards if successful. I have an idea that these rooms would soon become known and asked for. Were I situated in one of these towns, I think I would be prepared to risk a little capital and propose partnership with the landlord in such a scheme.

Discussion.

Mr. J. Ferguson Bell said that, with the view of starting the discussion on the paper, he should like to say that he was a thorough advocate of gas-fires; but he was not such an advocate that he could persuade or tell his consumers to put gas-fires in all their rooms. Before he could do so, there would have to be a radical alteration in the construction of gas-fires. In view of the paper, he had taken out a few figures as to the relative amount of heat that was obtained from 1s. worth of gas, coal, and electricity. As they knew, the electrical people were using electrical radiators for the heating of rooms; and he thought they had shown gas people an example of how to heat rooms. They were heating them, not by warming the air, but by radiation. English people were used to cool air; and they did not want rooms to be stuffy. It was the warming of the air that created a stuffy feeling; and the way rooms ought to be heated was by radiation. He found, if they took gas at 2s. per 1000 cubic feet, the number of British thermal units to be obtained from 1s. worth would be 275,000; but from a shilling's worth of coal at 15s. a ton, or 9d. per cwt., it would be 1,925,000 British thermal units. The gas, so far as heat was concerned, was theoretically seven times the cost of coal, taking the coal at 15s. per ton and gas at 2s., which were both low figures. When they recommended consumers to heat their rooms by gas-fires, they (as gas managers) ought to know that, in the theoretical cost of the two fuels, gas was seven times dearer than coal. Of course, as Mr. Stephenson pointed out, gas was easily applied, it was more cleanly, and there were many other advantages. But still it was costly. From 1s. worth of electricity, at 1d. per unit they would only get 27,500 thermal units. Therefore, with electricity at 1d. per unit and gas at 2s. per 1000 cubic feet, electricity was ten times the cost of gas, or seventy times the cost of coal. So far as electricity was concerned, gas had by a long way the start. Notwithstanding this, they found that people would use electrical radiators. The reason was that the electrical people utilized the whole of the heat energy; and what gas-fire people wanted to do was to conserve the heat energy. One of the most successful gas-fires he had noticed was that of Siemens. The bulk of the heating was by its radiant heat. It was a good and economical fire; and he was rather surprised it was not more largely used in this country. He thought that what gas-fire makers should do was, instead of copying coal fires, to strike out into a new line entirely, and construct gas-fires so that they could heat a room by the radiant heat. At the present time, they used clay balls or asbestos, or iron fret, all of which were more or less bad radiators. If instead of doing this, they used the luminosity of the gas for radiation purposes, they would get far better results. He was glad Mr. Stephenson had brought this paper forward; as he (Mr. Bell) thought there was a large field for gas-fires to be introduced. The number of gas-fires fixed was comparatively very small; and it behoved them as gas managers to encourage the fixing of gas-fires, either on hire purchase or simple hire, and also to encourage the best kind of gas-fires. He thought that their consumers unfortunately went in for the cheap fire in a large number of instances. The cheap fire might be a very dear fire if it were uneconomical in gas consumption. What they wanted to do was to recommend to their consumers not the cheapest fire, but the best fire as regards results.

Mr. W. C. Jones (Brierley Hill) remarked that the author had pointed out that gas-fires were unpopular; and he asked, why? In his opinion, the first cause was because the majority of gas-fires in use up and down the country were very badly fixed. It had been left largely in the hands of ironmongers to supply gas-fires and fix them. The consequence was they were not efficiently fixed, and were thus giving great dissatisfaction; and until gas managers or their officials took the matter in hand, and saw that gas-fires were fixed in accordance with correct principles, gas-fires would not become popular. He related an experience of some years ago where he had to deal with a bedroom gas-fire that had been condemned by a doctor. The doctor's complaint was justified. The fumes were getting into the room; the gas was not properly burnt; and there was more smell than heat in the room. Some time afterwards, when the patient who had been occupying the room got better, he (Mr. Jones) had a fire fixed in it. The doctor who had condemned the former one subsequently saw this, and then had some fixed in his own house. He was not quite sure that Mr. Stephenson's sketch of the way a gas-fire should be fixed in a grate represented the lines on which gas-fires would ultimately appeal to the public. He did not know whether Mr. Stephenson used any special means with regard to the flue. If not, he was afraid, owing to the way that many houses were built in some districts, he would have great difficulty in getting the products of combustion to go up the chimney, if he had not a different arrangement from the one shown. Mr. Jones here instanced how he had got over a difficulty with two refractory chimneys by fixing over one fire-place an ornamented iron plate such as Mr. Stephenson condemned so much, and over the other a tiled screen, thus doing away with the large area found in many house flues.

Mr. T. Berridge (Leamington) said there was one point that previous speakers had not noted, and which the electric light people never seemed to miss. They always said that, even if the electric light cost more, they saved by its use in decoration. If the gas-fire cost more than a coal fire, they saved it in servants' wages. One gentleman he knew had put the Kern fire right through his house. He admitted that it would cost £12 or £14

more a year; but he was, in consequence, doing with one servant less. In these days of the servant difficulty, this was a point they ought to keep well before their consumers.

Mr. W. G. S. CRANMER (Willenhall) remarked that, in the case of the gas-fire, they did not get heat by radiation; but they attempted to get it by means of a large mass of heated metal. In the case of the coal fire, the whole of the heat was obtained by radiation. They heard a good deal about the stuffiness of rooms heated by gas-fires. His experience was this, that it was not so much the dry atmosphere as it was bad ventilation. A gas-fire was generally put in front of an ordinary grate; and a chimney which was designed for a coal fire was supposed to answer just as well for a gas-fire. The products of combustion from a gas-fire were very much less in volume than those of a coal fire; and therefore for the former the area of the chimney (he was speaking now of the whole area) should really be less. In some offices he built a few years ago, he put flues into the walls 4½ inches square. In his own office, the gas-fire was sometimes burning night and day; but one could never tell, unless he saw it, that there was a gas-fire in use there. The air was always as fresh as if the room was heated by a coal fire. He was sure the flue had a great deal to do with the stuffiness of a room heated by a gas-fire. If he had the same job to do again, instead of using a 4½-inch flue, he would put in a 3 or 4 inch glazed drain-pipe, which was clean, and nothing could catch on to it. It would answer the purpose much better than a flue. If they could only persuade architects, where gas-fires were to be used for bed-rooms or reception-rooms, to put in flues designed for the purpose, he was sure they would hear fewer complaints about gas-fires.

The PRESIDENT said he thought it was a good idea on Mr. Stephenson's part, from his point of view, to read his paper so that the members should tell him how the paper ought to have been written. He said he had written his paper with the object of the members giving him or the gas-fire people ideas as to how they should make gas-fires. If, however, they could carry that in mind, and work upon it in some other directions, he thought it might be of some personal benefit to them. (Laughter.) He thought that, as the reader of the paper, Mr. Stephenson should have laid down what he thought a gas-fire should be; and he should have brought them a model or drawing of a gas-fire which he regarded as second to none in the world, and which he was prepared to swear by. Mr. Bell, in his remarks, went into the comparative costs of gas-fires and coal fires. He (the President) would not venture into that; but in Appendix E to his Inaugural Address he showed (from a rough working) that gas to be equal to coal at 13s. 4d. per ton must be sold at 9½d. per 1000 cubic feet. If, however, they took into consideration the work and so on, they might take it that 1s. 6d. was the figure. He was interested to hear Mr. Bell bring out the point which was the one essential, and which was overlooked in all gas-fires. Mr. Bell said he considered they should go in for luminosity in gas-fires. They knew, as children, there was nothing to touch the sun for heat and light. They also knew that, when they saw the sun, they never felt any stuffiness; but if the sun became obscured behind clouds, then it was they talked of a sultry day, which was because they got the convected heat from the earth. The same thing applied to a room—the stuffiness was brought about through not having sufficient ventilation or no proper radiation. Mr. Jones called attention to the fixing of gas-fires. The difficulties of obtaining good fitters were common experience. Mr. Berridge spoke as to the saving of servants' labour in a house by the use of gas-fires, and that was an important point. With Mr. Cranmer, he quite agreed as to the use of glazed pipes for flues.

Mr. STEPHENSON, in his acknowledgment of the kind way in which the paper had been received, said he certainly did not expect it would be agreed with thoroughly: but he had been somewhat amused to hear the President's criticisms. Mr. Helps claimed that he (Mr. Stephenson) came there without any ideas of his own, but to get ideas from the members, and then he proceeded to assist him by replying to the discussion. (Laughter.) He thought that one idea in reading papers was to get ideas from the members. But he did not think he had come there without any ideas at all. He put forward one fire (the Kern radiator) that he considered the most perfect on the market at the present time. He had also given his own idea as to the setting of a gas-fire in an ordinary coal grate; he preferred a fire set in a grate similar to the sketch shown. Those were his ideas. He agreed with Mr. Bell with regard to the system of heating; it should be by radiation. If they did it merely by warming the air, they did get a certain amount of stuffiness. Part of the idea of the filigree work round a gas-stove was intended by the makers to form air-chambers for the purpose of heating the air of the room; but the room so heated was not comfortable. Mr. Bell said the theoretical cost of gas heating was seven times that of coal. The President, according to his address, gave it at about double. This was how he (Mr. Stephenson) took it; and he did not think it worked out to seven times the cost of coal. [Mr. BELL: I said theoretically.] There was doubtless a lot of waste heat with coal heating. Electricity, he thought, was looked upon very much as a luxury, and as not giving very much efficiency. He fancied a room "heated" by electric radiators would be rather cold. Then Mr. Bell and the President also harped on gas-fires being luminous. Well they had two luminous fires—the reflector fires (which did not give a great deal of heat), and the log fires, which did not give much heat for the gas consumed, and which would make a bad smell if there was not good ventilation. Mr. Jones attributed the unpopularity of gas-fires to their being badly fixed. This went a long way. But many of them were not only badly fixed for carrying off the fumes, but they were ugly, especially when an iron plate was put up. Mr. Berridge had raised the question of the advantage of the gas-fire in connection with the servant difficulty; and he (Mr. Stephenson) did not think this was taken sufficiently into account. Mr. Cranmer called attention to his office, to the fact that he had only a small flue, and that the place was sweet with a gas-fire and well-ventilated. Of course, Mr. Cranmer paid more attention to the ventilation of his office than was the case in many dwelling-houses.

Mr. MEIKLEJOHN proposed a vote of thanks to Mr. Stephenson for his paper. He was one of those who did not quite agree with all that Mr. Stephenson had said, and especially in regard to the canopy of the old gas-fire. His own impression was that the canopy was not big enough. It was an excellent thing to have a large canopy over a gas-fire in order to let it get a good start, as it was just after the lighting of a fire that it was most offensive. At his own house, in the drawing-room they used a gas-fire; and they never had any trouble whatever, though it was a "common or garden" fire such as was so strongly despised by Mr. Stephenson. He (Mr. Meiklejohn) thought it was all a question of good ventilation and having a good chimney draught. In his own experience he never could get any heat from a Kern radiator. It was pure heat; but it was even more poor than pure. (Laughter.)

Mr. R. JONES (Dawley) seconded the motion. Speaking of gas fires, he said the great difficulty he had to deal with himself was down-draughts; and no matter what system was adopted, if the doors of the rooms were frequently opened and closed, there was trouble with the products of combustion coming into the room. He had a fire in his bed-room; and it worked all right so long as the door was kept closed. When it was open, the products of combustion were drawn down into the room. He spoke appreciatingly of the work that had been done on this subject by Mr. William Sugg, referring particularly to a paper read by him some years ago. Concluding, he said he was firmly of opinion that if gas-fires were put to work with ordinary chimneys, the results were not at all good. For a time a stove might go on all right; but sooner or later, there would be disaster, and the stove would be condemned.

The motion was very heartily agreed to.

Mr. STEPHENSON replied, adding that as to down-draughts, with all gas-fires there was a little; but if all was well-arranged, it did not last long.

VOTE OF THANKS TO THE EX-PRESIDENT.

Mr. CHARLES HUNT said there was one duty still to perform. That was to propose a hearty vote of thanks to the retiring President. Mr. Meiklejohn had served the office of President most admirably; and they had had a very successful year under his conduct. Those of them who were fortunate enough to attend the meeting at Rugby were favoured by the hospitality of his Company; and they would not easily forget it. The second meeting was held at Walsall, where the Association were also well received and entertained. He was sure they would all accord Mr. Meiklejohn a hearty vote of thanks for his care of the interests of the Association during the past year.

Mr. FOWLER, in seconding, thanked Mr. Meiklejohn personally, as well as a member of the Association, for his courtesy.

Mr. MEIKLEJOHN said he was much obliged to the members for the kind way in which they had received this vote of thanks. He undertook the office with no little misgivings, and that he had succeeded in gaining the approbation of the members at the close was owing very much to their indulgence. He had always had the interests of the Association at heart; and he should be happy to do all he could to continue to advance them.

MR. MEIKLEJOHN'S TRIP ABROAD.

Mr. W. B. COOPER (Banbury) said they must not let their Past-President go without their best wishes. It might not be known to all the members that, in a few days, Mr. Meiklejohn was taking a six weeks' holiday. His Directors so much appreciated his work that they had given him the wherewithal to go on. Every one of the members would wish him joy, and express the hope that he would return enabled to discharge his duties with the assiduity and success that he had shown in the past. There was a necessity for the trip; and they all hoped the holiday would have the desired effect.

These remarks were cordially endorsed by the members; and the meeting terminated.

An oxy-acetylene blowpipe is described by M. Fouché in the Bulletin of the French Physical Society. The flame is formed by the combustion of a mixture of one part of acetylene to one-eighth part of oxygen; and in order that the explosion may not travel back into the pipe, a jet velocity is required, due to the pressure of a water column 13 feet high. The flame melts most metals readily; it will solder iron and steel. Even silicia and lime are melted by it. With a reduction of the proportion of oxygen, the flame becomes luminous; and on falling on lime, the free carbon goes to form carbide of lime.

THE ACETYLENE ASSOCIATION.

Third Annual Meeting.

The Third Annual Meeting of the Acetylene Association was held last Thursday at the Westminster Palace Hotel—under the chairmanship of Sir Charles S. Forbes, Bart.—when satisfactory progress was reported with regard to various matters which have been engaging the earnest attention of the Executive during the past twelve months. The attendance of members was not so large as might have been expected, considering the importance to the industry of the subjects that had to be considered; but all those who were present took a more or less active part in the proceedings. Before turning his attention to the ordinary business, Sir Charles Forbes expressed the great regret that was felt at the absence, through illness, of Mr. F. G. Worth, who had been elected Chairman of the Association, but had refused to remain even a member of the Executive while the condition of his health precluded him from participating in the work. Under these circumstances, it was decided to co-opt Mr. Worth to the Council as an ordinary member pending his recovery.

Conditions of Carriage of Carbide by Rail.

The Chairman, referring to the work done by the Association during the past year, said that first of all the question of the carriage of carbide of calcium by rail had caused a good deal of trouble. At the last meeting it was reported that the Committee of Railway Goods Managers had agreed in principle to modify the rule as to requiring the same form of consignment and advice for carbide as for the "Most Dangerous Goods." Since then, they had arranged with the Committee the exact wording of the consignment note and advice for the carriage of carbide; and the regulations had been relaxed a little. This might not seem to be a very great achievement; but, at any rate, it was something. Next they approached the Committee with a view to obtaining some modification with regard to the packing of carbide; and they had that morning received a reply from the Committee which went far towards meeting their suggestions. This reply would have to be considered by the Executive; but it would be seen that they were moving in the right direction.

Mr. Shore remarked that he could not help thinking a very great deal would be done if the Association could arrive at some definite idea as to what was really the best standard method of packing. He would also like to see the adoption of the metric system of weights and measures in place of the existing one.

The question of the packing of carbide was then referred to the Executive to deal with.

Local Government Board and Loans.

The Chairman said the next body they were in communication with was the Local Government Board; and with regard to this matter Mr. Worth had written a letter giving them some valuable hints. The contents of the letter were communicated privately to the members; the Chairman remarking that the point to which they wanted to fix the Local Government Board was whether they could or could not allow loans for the purpose of lighting by acetylene. Information reached the Executive that the legitimate enterprise of firms tendering for installations of acetylene lighting in public buildings, &c., had been hampered by the action of the Board with reference to the granting of loans for the purpose. The attention of the Board was called to this fact; and the matter is still under discussion.

Pressure Limit for Generators—The Association's Tests.

At the last meeting it was stated that one firm of generator makers had refused to conform to the regulations issued by the Association, which stated that anyone making apparatus which went beyond 20 inches pressure must have an exemption. The Council offered to look thoroughly into the plant, and to recommend exemption to the Home Office if they found it safe; but the firm demurred to this, stating that the apparatus had been at work for several years without any accident. Mr. F. L. Rawson, a member of the Association, ultimately offered to test the generator free of charge; and the matter was allowed to stand over in order to give the firm another chance of submitting. The Chairman, however, now reported that the offending member had not seen fit to apply for an exemption; and there appeared therefore to be no other alternative than to instruct the Secretary to decline to receive his subscription for the current year. He said that if a firm absolutely disobeyed the rules of the Association, they could not recognize a partner in the firm as a member. The Home Office had asked them to grant certificates for generators; and they could not give the firm a certificate.

Mr. Shore said the Home Office would grant a certificate at a higher pressure than was accepted by the Association as being the proper standard. The Chairman, however, replied that this was not the case; they had to make their pressures the same as the Home Office ones. At one time the Home Office allowed 100 inches pressure; but they did not permit anything like this now. He was present at the meeting when the pressure of 20 inches was decided on. The 100 inches pressure was only fixed temporarily, and was never a standard. Mr. Bingham pointed out that the Home Office did grant the Association power to recommend that a higher pressure should be used in certain cases; and they were perfectly prepared to recommend that a higher pressure for this particular generator should be allowed, if the firm had given the necessary facilities.

The Testing of Generators.

The Secretary was, in view of the growth of the conviction as to the comparative innocuousness of carbide, instructed to write to the Home Office pointing out the hardships which existing regulations as to licences inflicted on all connected with the carbide industry, and making suggestions as to increasing the weight that should be allowed to be stored. A reply was received from the Home Office; and as the result of the correspondence, the Chairman said the Home Office wished to place the burden upon the Association of saying what generators were safe and what were not. The question was, How far should they accept this responsibility? If they were constituted the authority in this matter, their certificates ought to be sufficiently plain to show what they meant. He thought the only satisfactory way of attaining this end would be for the dimensions as well as the designs of certified generators to be given. They were all perfectly aware that what would do for a small vessel would not answer in the same way if it was made ten times larger; so that it would not be only the type and principle of the generator that would have to be dealt with, but also its dimensions. They must, however, be very careful that they did not cause the infliction of greater restrictions than they already suffered from, instead of making things easier for the members of the Association. The Association would be paid for doing the work by the people who wanted their generators tested.

After a few remarks had been made by the members, it was decided to consider this matter also in Committee.

A Proposed Acetylene Exhibition.

The Chairman remarked that it seemed to him that, if they had to carry out these tests of generators, the best way would be to hold an exhibition. This would enable the tester to have all the machines together, and would be some recompense to the makers for the trouble and expense to which they would be put.

Mr. Shore thereupon moved that an exhibition be held by, and at the profit of, the Association. This led to considerable discussion. Mr. Fawkner thought it would be best to ask, say, the Royal Agricultural Society to set aside some space in their show where generators could be exhibited in operation. They would thus be seen by the very class of men that acetylene appealed to—country gentlemen. The Chairman said he favoured Earl's Court, as there they could have the generators outside and the different forms of light inside the buildings. Mr. Beaumont asked that a vote of the whole of the members should be taken as to the most convenient town in which to hold the exhibition, and the Chairman said this would be done.

Other Matters.

Among the other matters introduced to the meeting was the question of issuing under the auspices of the Association a popular pamphlet on the advantages of acetylene. This was left for the Committee. It was also agreed that the Association should remain, as at present, absolutely independent of the newly-established journal of the industry, "Acetylene." Some correspondence was read on the subject of the existence of a regulation of the India Office prohibiting the shipment of official goods by any vessel which carried carbide. Finally, the Secretary and Committee were empowered to do what was needful to permit of an addition being made to the number of members constituting the Executive.

The proceedings terminated with a hearty vote of thanks to the Chairman for presiding.

The death occurred last Wednesday, at his residence in Leamington, of Alderman Henry Bright, J.P., who some years ago took an active part in obtaining for the town a better water supply from wells sunk on the Campion Hills, the yield of which was 600,000 gallons per day. The deceased gentleman was in his 87th year.

We have received from the "Electrician" Printing and Publishing Company, Limited, the "Electrical Trades Directory and Handbook" for the present year. As this is the 22nd year of publication of what is now generally known as the "Big Blue Book," the electrical world, and also many gas engineers and managers, are perfectly familiar with its varied contents. The book has not been inappropriately described as the "Kelly and Whitaker" of the electrical industry, seeing that the contents now occupy 2000 royal 8vo. pages, which are filled with financial, technical, and directorial information relating to electrical matters. This has been corrected up to the 11th ult., so that it may be regarded as quite up-to-date. Accompanying the volume are the large sheet tables—somewhat unwieldy to handle, but presenting to the view a mass of valuable statistical matters—which have for a long time been a feature of our electrical contemporary. Some of these have been corrected up to the 15th ult.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The members of the Institution were at Manchester betimes last Saturday morning, and in rather more than average number. The attendance must have been somewhere about eighty. The cause of their early appearance was that the Hon. Secretary (Mr. H. Kendrick) had secured permission for the members to visit the Westinghouse Company's works, which are situated in the Stretford Gas Company's area of supply. At 10.30 two electric cars were waiting in Piccadilly to convey the members to Trafford Park. On arriving at the works, the visitors were received by Messrs. J. G. Walthew, G. J. Wells, Wood, Cox, Coronel, Mortimer, and other members of the staff, each of whom took charge of a small party and showed them round this really magnificent and wonderful establishment. The unbounded courtesy and information of these gentlemen were much appreciated; and the interest attaching to everything that was seen caused the morning to pass all too rapidly. We are reserving a descriptive account for publication next week.

Returning to the Mosley Hotel, the members lunched together; but this formal arrangement occupied a considerably longer time than is the case when, as is usual, the members look after their own individual requirements in this direction. The time set apart for the meeting was in consequence encroached upon, which is rather a pity in view of the very full programme.

The Meeting.

On the retiring President (Mr. S. R. Ogden, of Blackburn) taking the chair, the business was at once proceeded with.

The Hon. Secretary (Mr. H. Kendrick, of Stretford) read the minutes of the meeting held at Halifax on Nov. 28; and, on the motion of Mr. Henry Hawkins (Todmorden), seconded by Mr. W. W. Hutchinson (Barnsley), they were confirmed.

Annual Report and Accounts.

The Questions of Affiliation and Commercial Sections.

The Hon. Secretary then read the annual report of the Committee and the accounts. In addition to a review of the doings and the work of the year, the report contained the following paragraphs:—

The Commercial Sections at Bradford and Manchester have been very successful, and much useful information has been tabulated, and circulated among their members. The Blackburn and Stoke Sections have, however, suffered from lack of support, owing to the fewness of their members, and the scattered nature of the districts; and it is suggested that they should be amalgamated with the Manchester Section.

The Committee have fully discussed in all its bearings the question of affiliation with the Institution of Gas Engineers; but as no definite plan was before them, they finally decided to forward the following resolution to the Council of the Institution:—

> "That the Committee of this Institution is prepared to recommend the members of the Manchester District Institution to become affiliated to the Institution of Gas Engineers, subject to the scheme being workable and of general advantage to the gas industry, and would suggest that a Sub-Committee be formed co-opted with the Presidents of the eight District Institutions to consider the question and to formulate a scheme."

This was done in time for the last meeting of the Institution Council; and your Committee have since been informed that their recommendation had been accepted, and that a strong Committee had been formed to go fully into this question and other matters arising out of Mr. Dougall's presidential address.

The membership roll shows a slight diminution, and now numbers 146 members. Death has claimed two of our old members in the persons of Mr. W. H. T. Norfolk, of Leek, who had been a member since 1885, and Mr. Richard Merrell, late of Mossley, who joined the Institution in 1887. Three members have resigned, one has left the profession, two ceased membership under Rule 14, and two have left the district and ceased to be members; while, on the other hand, seven new members have been added to the roll.

Your Committee note with peasure the increasing vitality of the Institution, and the growing desire of the younger members to participate in the responsibilities as well as the privileges of membership. This augurs well for the future success of the Institution, which they are sure will be even greater than in the past.

The accounts showed a balance of £28 17s. 1d.; outstanding subscriptions amounting to £3 3s.

Mr. T. Banbury Ball (Rochdale) asked whether any suggestion or report was going to be made on the question of the Commercial Sections beyond the reference contained in the Committee's report.

Mr. W. Prince (Stoke-on-Trent) said with respect to the part of the report which referred to Stoke-on-Trent and neighbourhood, they had been unable to form any section which would be of any mutual benefit whatever. They had a district comprised of both the Midland and Manchester Associations; and it was found that they worked a little in opposition, or rather there were some who did not feel there was any good to be derived from connection with this Commercial Section. Consequently, they had to let it drop in their district partly for this reason and partly on account of the scattered character of the district.

The President said that, so far as Blackburn was concerned, he might mention that they had had several meetings, and tried to do what they could; but owing to the difficulties of arranging a specific day of the month on which to meet, they had not been able to get a sufficient number to attend to do any good. However, there was another side to the question—that was, that six or seven members felt they would like to keep the section going, if they could do it by getting any information through the Manchester Section. What he meant by this was that the six or so members were so far away from Manchester, that it would be inconvenient for them almost at any time to attend the Manchester meetings. He had thought of a suggestion, and it had been considered somewhat, to see whether he, as the Chairman of the Blackburn Section, could be enabled to join the Manchester Section, take up his costs and the usual expenses, and be allowed to utilize the information obtained from that section for the benefit of those members of his own section who could not attend the Manchester one. There were perhaps some disadvantages in this to the Manchester Section, in so far as those members would not be of their section; and therefore the Manchester Section would have no control over them. However, this question he proposed to bring before the Manchester Section later on. Certainly so far as the number mentioned of the members of the Blackburn Section was concerned, the difficulty pure and simple had been one of fixing a convenient day. Otherwise, they would have been able to go a little bit farther in the matter than they had done.

Mr. Prince, in moving the adoption of the report and accounts, said he thought the members would agree that they had had rather a busy year. The chief item of the report was the resolution as to the advantages to be gained by affiliation with the parent Institution; and this he trusted would not be lost sight of. He understood that the recommendation of the Manchester Institution had been adopted by the Council of the parent Institution as the basis for the Associations to work upon.

Mr. C. Elliott (Leyland), in seconding, said with regard to the portion of the report referring to the commercial work of the Institution and the Blackburn Section, he was one of the five or six members mentioned by Mr. Ogden; and he could assure the members generally, that it was their desire, small as their number was, that they should not join the Manchester Section at present, but continue for a little while in the position in which they found themselves placed.

Mr. Hutchinson desired to call the attention of the Committee to the desirability or otherwise of devoting a limited portion of their funds in the provision of a suitable lecture on some occasions, instead of spending the money in mitigating the costs of the day. They might arrange for lectures on current topics of interest to the members, by experts on the subjects. He should like the Committee to take this matter into consideration, with the view of working it out.

Mr. Prince took it that this was one of the objects of affiliation with the Institution, to enable such things as this to be done.

The President said they had already taken up the question of initiating such a step; but the matter must be left for the further consideration of the Committee.

The motion was unanimously carried.

The New President.

Mr. Ogden said it was now his duty to vacate the chair, and induct their new President (Mr. H. Townsend, of Wakefield). In doing so, he trusted that Mr. Townsend would have good health to carry out the duties, and that he would have at all times the assistance of the members and of the Committee.

The President having taken the chair, at once proceeded to read his

INAUGURAL ADDRESS.

In the first place, allow me to thank you most heartily for the honour you have conferred upon me in electing me to occupy the position of President of this important Institution. It is a position which I have not sought in any way; but it is one which any gas engineer might well be proud to occupy. The remembrance of the many distinguished Presidents who have preceded mein this chair makes me feel, however, a considerable amount of diffidence as to my ability to follow them acceptably; and I can only rely upon the support of our strong and capable Council, and the co-operation—always so cheerfully rendered—of the general body of members, to enable me to maintain undiminished the high prestige of the Institution during my term of office.

If the occupation of this chair has its advantages, it has also one very serious drawback, in that it involves the holder of it for the time being in the necessity for reading an address; and the difficulty of saying anything new or worth listening to becomes very great in these days when presidential addresses are so numerous and when the Press is so ubiquitous that everything which happens in the world to-day is duly chronicled to-morrow, and when our own special Technical Journals are so very efficient that nothing interesting can occur throughout the world in our own domain without being at once appropriated and duly publicized. However, whether worth listening to or not, custom

the inexorable, compels me to claim your indulgence for a short time while I endeavour to put before you some of my own particular views upon various phases of our professional work.

Like the industry to which we belong, the Manchester District Institution shows gratifying signs of virility and expansion. Eight new members have been added to our roll during the past year. Death has claimed two members of long standing in Mr. W. H. T. Norfolk, of Leek, and Mr. Richard Merrell, late of Mossley; leaving our numbers at the gratifying total of 146 members. During the past year, we have had the pleasure of seeing a second lusty junior offshoot come into existence; and the Yorkshire Junior Gas Association bids fair to take a high place among junior organizations, with its encouraging muster of about sixty earnest and studious young men. The Manchester Junior Association, with its 67 members, continues to do excellent work, and shows every evidence of continued vitality.

In thus having two sturdy off-shoots, our Institution occupies an unique position among the District Gas Institutions of the country; and I think it will behove us to consider in the near future how we can best encourage and stimulate these Junior Associations. As a first step we might invite their Presidents for the time being to attend the meetings of the Institution. This would bring Junior Associations into touch with us, and we should get to learn something of their aspirations and aims. The multiplication of these Junior Associations makes the "Beckton Incubator" for gas engineers seem rather superfluous, as so far from there being a dearth of candidates for appointments in our profession, the danger would rather appear to be excessive competition, with its undesirable results. Another sign of the vigour of our Institution is the spread of the Commercial Sections among us. The Manchester branch shows abounding vitality, and now numbers 34 members; while the past year witnessed the formation of the Yorkshire Commercial Section, with a roll of 37 members, and a record so far of most useful work.

Commercial Department.

The beneficial effects of the adoption of the commercial side of this Institution, I think, will be readily admitted by all of us. Formerly each had to buy his raw material and sell his residual products with nothing else to guide him but his own commercial instincts and the statements in the Press—technical and general; and while freely admitting the enormous value of these sources of information, yet we now find that the comparing of notes with each other is an additional weapon of enormous utility. I have heard it asserted many times that our commercial branch is a ring to artificially inflate prices. Nothing could be further from the truth. We neither attempt nor desire in any way to control prices. Our sole aims are the dissemination of information among our members, and the avoidance of cut-throat competition with each other. Every member of our Institution has the fullest liberty to buy and sell at whatever price he likes, totally unhampered by any other member or members. The beneficial result of the working of this new commercial branch on the part of my own Company at Wakefield is seen in the following figures extracted from our balance-sheets for the past two years:—

Year.	Make of Gas.	Cost of Coals.	Return from Residuals.	Cost or Coals less Residuals.	Actual Saving.	Percentage of Return on Cost of Coal from Residuals.	Net Cost of Coals, less Residuals, per 1000 Cubic Feet of Gas Made.	Saving per 1000 Cubic Feet of Gas Made.
	Cubic Feet.	£ s. d.	£ s. d.	£ s. d.				
1902. Before the introduction of the commercial branch . .	270,784,000	13,727 4 1	9,351 15 3	4,375 8 10	..	68·12	3·87d.	..
1903. After the introduction of the commercial branch . .	275,489,000	13,354 14 11	11,024 6 9	2,330 8 2	2,045 0 8	82·55	2·06	1·81d.

It would not be fair to claim all this saving to the introduction of the Commercial Branch, as nothing of the sort can affect market values; but the fact remains that, with a falling market for coals, we obtained £1673 more for residuals, which speaks volumes for the utility and value of this new departure.

Pushing Gas Consumption.

At our last meeting, we had valuable papers and an informing discussion upon the advisability of following our gas into the homes of our consumers; and the opinion seemed pretty general that it would be advisable to take this step if we are to retain and increase our business. The incandescent light, while it has enormously strengthened our position, requires skilful looking after to keep it up to the mark; and several of us have found it necessary to go in for systems of maintenance. At Wakefield, we started this system in 1901; our terms being 4d. per burner per month. For this figure, we paid fortnightly visits to our consumers, and kept the burners clean and in good order, and renewed mantles and chimneys when necessary. The result was that the first year we lost £10 19s. 4d., and in the second year we made a profit of 13s. 9d. Not very many consumers entrusted us with this duty; so to try and extend the system, we lately reduced the price to 3d. per burner, with monthly, instead of fortnightly, visits where the number of burners is less than six, and we make special quotations where the burners are above that number. We have reduced the visits from once per fortnight to once per month, as we find it is the fitter's time which runs away with the money. If the mantle goes wrong between our visits, our fitter attends at once upon receipt of a request to do so. After six months' experience, we find that monthly visits give as much satisfaction as fortnightly ones. In the case of consumers with a large number of burners, we attend once a week.

A very interesting phase of the discussion at our last meeting was the position of the gas-fitters and plumbers; and it was generally agreed that gas undertakings had not much to hope for from these gentlemen. The average gas-fitter or plumber is not of a very pushful disposition, and considers his duty is performed if he attends to the orders he receives from his customers, duly charges them for his services, and keeps in stock some of the articles they require. At Wakefield, we have not yet got so far as fitting up the houses of our consumers through ordinary meters. We have put fittings into about 2500 cottages with slot-meters; but in this case we found the money for the work. With our ordinary meter consumers, however, if we supplied fittings, we should, of course, have to charge for them.

We have hitherto felt a natural reluctance to take this work out of the hands of the plumbers and gas-fitters, and would certainly not do so if they would canvass the district and push business; but the pressure of the keen competition we now have to face, and the fact that all kinds of people now sell gas-burners and mantles, may ultimately compel us to adopt this course, in the interest both of ourselves and of our consumers, for they ought to have some guarantee that the burners or mantles they are purchasing are of good quality and worth the money they are giving. They also require advice and assistance in the proper method of fixing and using them. This brings us to the question of the best method of instructing our consumers in the use of the various gas appliances; and there can be no doubt that nothing is so informing to the average person as seeing such things in actual operation. It is a comparatively simple matter to have a show-room where the offices of the undertaking are in some important thoroughfare; but where they are connected with the gas-works, which are generally in an out-of-the-way part of the town, then the question of rent, rates, and attendance crops up, and demands careful consideration to determine whether the outlay will be profitable. I am personally strongly inclined to think it would.

During the discussion before alluded to, it became evident that it was considerably more difficult to deal with the consumers' fittings where the gas-works belonged to a corporation than where they were the property of a company, as such questions as municipal trading, rights of ratepayers and Trades Unions, cropped up, and made it necessary for the gas manager to be extremely cautious in making this new departure from traditional practice.

Free Services, &c.

In Wakefield, we have adopted the system of supplying and fixing house services, gas-stoves and fires, free of cost, with the exception of a small charge for the hire of the latter; while we supply free to all classes of our consumers, burners, boiling rings, and flexible braided tubing. We are convinced that the adoption of these aids to increased consumption far outweighs the cost, as it leads to greater contentment and satisfaction among our consumers, and, of course, increases the output. I should not be at all surprised if free mantles were to follow before very long, and perhaps we shall ultimately have to supply cookers and fires free; and we await with very great interest the result of the experiment in this direction now being made by the Corporation of Manchester. In fact, I am quite convinced that the easier we make the use of our gas to the general body of consumers the better for all concerned.

No doubt these things will tend to keep up the price of gas to the consumer; but the incandescent burner, by reducing so much the amount of gas used for lighting, has rendered the price of gas for this purpose of less vital moment than formerly. In this connection, I think the tendency of the future will be more in the direction of differential prices than hitherto; for, in order to hold our own with our competitors, we must sell our gas for heat and power at the lowest possible figure, while for light, it does not seem to me to be so necessary to get the price down, as we are already so very much cheaper than our competitors.

Shop Lighting.

There is one field in which I think we have surrendered our ground too easily to our competitors. I refer to the lighting of

shops. In nearly every town the bulk of the best shops are lighted by means of electricity. I carefully examined a number of shop windows in a large town the other evening, to see, if I could, wherein lay its attraction to shop-keepers, and noticed one feature which no doubt commended it to them is that it can be put amongst fancy articles and draped with coloured silks or papers. In this particular direction, it is not easy for us to compete. The best lighted window I saw was one illuminated by means of incandescent electric lamps right at the top of the window. Each lamp was surrounded by a conical silvered glass reflector, which threw all the light down upon the goods. These happened to be boots and shoes, which are not by any means the easiest things to display to advantage. The passer-by could not see whence the light proceeded, without purposely looking up for it; but the goods were exhibited in the best possible manner, and there was nothing to distract the eye from the articles in the window, and that, I take it, is the best form of shoplighting. A shop may be brilliantly illuminated; but if the lights themselves catch the eye, so that the goods take only a secondary place, then it seems to me this is a faulty method.

Upon inspecting this piece of lighting more closely, I could not help thinking how easy it would have been to have lighted this window even more effectively by means of incandescent gas-burners fixed in a similar manner at the top of the window, and the light thrown down by means of silvered glass reflectors. The products of combustion could have been taken away by a ventilating arrangement, which could also have ventilated the shop at the same time, or, if preferred, and presuming the window was sufficiently lofty, a glass partition could screen off the contents of the window entirely from the gas-burners, which would then be enclosed in a ventilating glass box, so that there could be absolutely no contact between the gas and the goods in the window. It would not be difficult to make suitable arrangements for lighting the burners and renewing the mantles. I wonder some of our expert gas-fitting manufacturers do not turn their attention more in this direction. Outside incandescent gas lamps seem to be coming more into favour for shop window lighting, and several enterprising gas companies are supplying them on the hire-purchase system.

A short time ago, a tradesman was discussing with me the lighting of his extensive shops. He had followed the prevailing craze and installed electric lights, but was considerably taken aback when his bills came in, and soon reverted to gas lighting. He found the electric light suited neither his pocket nor his business—he had difficulty with his colours. During our conversation, he plaintively remarked to me, "When I use the electric light, my place is too cold, and when I use your gas it is too hot. What am I to?" Well, the remedy naturally suggests itself—viz., a combination of the two lights.

An architect made some remarks to me the other day with a somewhat similar bearing. He had quite recently carried out the erection of extensive shops and, as usual, had fitted them up entirely with the electric light; but after doing so, he found they were too cold. I suggested a combination of gas and electricity to him, pointing out that in this way he could keep the temperature completely under control, and, moreover, he would have very much greater security, for if the electric light popped out, as it has such a habit of doing, the shop would still be lighted with gas. He was much struck with my arguments, and said he would certainly have gone in for both lights if our conversation had occurred a little sooner.

I think these two gentlemen voiced the general feeling with respect to the lighting of shops; so why not try to meet their requirements. I am afraid we can never hope to recover shop lighting altogether; but I think, by judicious efforts, we might get a portion of the business in nearly every shop, for the beautiful inverted, and apparently inverted, gas-burners now in the market would blend admirably with electric light fittings, and would give the needful warmth and security to the tradesmen's premises.

The appearance of shops is often spoiled by steam on the windows. The use of gas is very often blamed for this, and many tradesmen have discarded gas and gone in for electricity in order to overcome the difficulty. I remember some years ago being much puzzled with this phenomenon in two new lofty and contiguous shops in a certain town. Both used gas generously. In one the windows were always perfectly dry and clear, and in the other they were invariably badly steamed after dark and often during daylight. The latter adopted the electric light, while the former adhered to gas; and I watched the result with keen interest. The adoption of the electric light reduced the trouble to some extent, but still the windows remained somewhat opaque; while the one using gas was, as before, perfectly free from steam, even on muggy and foggy evenings.

I gazed at these two shops for some time before discovering the reason; but at last noticed a ventilating grating the whole length of the top of the dry window, while the steamed window had no pretence at ventilation whatever. I then inspected numerous other shops to see if ventilation was the cause of the difference, and found that it was. The windows were all right which had efficient ventilating appliances, and all steamed more or less where ventilation was absent. Of course, when one comes to think over the matter, the reason is obvious. When the air in a shop is warmer than it is outside, it will contain a good deal of moisture in suspension; the glass window will take the lower temperature, and will then condense the moisture in the air with which it comes in contact.

The remedy is to keep the air which comes into contact with the glass the same temperature as the glass; and this can easily be done by admitting a current of cold air at the bottom of the window, and letting the heated air escape at the top, or, in other words, ventilating the shop window, care being taken at the same time to exclude the dust by means of suitable screens. This is such a simple thing to do, that one wonders that any shop front should be without it. But I suppose the great majority of shops throughout the country suffer from steamed windows for want of such a simple remedy, and our industry has had to bear the penalty of the omission.

Governors, Gas-Heated Baths, &c.

Now that the incandescent gas-burner is so largely used, it becomes more than ever necessary to prevent variations of pressure during lighting hours. Who has not experienced the necessity in a private house, without a governor on the outlet of the meter, of continually turning the supply of gas up or down as the incandescent burners required it? I invariably recommend consumers to adopt governors, where they have incandescent burners.

This has led me to consider whether it would not be possible to keep the pressure uniform over whole districts. I have consequently fixed governors which give constant outlet pressures underground on mains up to 4 inches in diameter, and have had some working for eighteen months without a hitch of any sort. In one district in particular, covering an area of about half a square mile, and fed from the two opposite extremities by two 4-inch mains, I fixed two 4-inch governors. There are churches, schools, public-houses, private houses, and one small factory within this area; and so far I have not had a single complaint from the district. I therefore think there is something to be said for this practice, if it has not before been adopted.

One of the most promising channels for increasing the use of gas is in the direction of heating water in buildings, both public and private; and I am convinced that in this direction lies a large field for the exercise of our ingenuity and resource. The great dearth of capable servants, and the increasing difficulty housewives are experiencing in procuring them, renders it often obligatory on the ladies of a household to do all their domestic work themselves; and we shall earn their gratitude, if we can help them out of this dilemma when it arises, and at the same time benefit all connected with our industry. The gas-cooker, gas-fire, and bath-heater are already splendid aids to the worried housewife; but the necessity for considerable quantities of hot water for washing up and other domestic purposes still makes it difficult, and in many cases impossible, to dispense with the kitchen fire, even in the hottest weather. This increases enormously the dirty and unpleasant work which has to be performed by the ladies of the household; and if it could be obviated by any means at our command, our services would, I feel sure, be highly appreciated, and considerable business would result.

Hot water for baths, &c., is generally provided in ordinary dwelling-houses by means of a boiler at the back of the kitchen range. There is usually a copper cylinder in connection with this boiler, to facilitate the accumulation and delivery of the hot water. It would be a very simple and inexpensive matter to provide this cylinder with a copper casing and a flue pipe into the nearest chimney, and to heat it by a series of gas-jets. Then in hot weather, or whenever else desired, the kitchen range need not be used at all. This gas-heated cylinder would provide all the hot water required, a gas-cooker would do all the cooking, and gas-fires would be at hand to warm any room which needed warming. The difficulty of managing without servants would thus be immensely lessened.

In a large public establishment in Wakefield, there is in highly successful operation an excellent piece of apparatus for providing large quantities of hot water. It consists of a powerful gas-heated tubular boiler made of copper, and about 2 feet in diameter by 2 ft. 6 in. in height. This boiler is in a cupboard on the ground floor; and when the door is shut, no one would guess there was any such thing about. It is provided with an efficient flue conducted into an adjacent chimney. This flue takes away all the products of combustion. The boiler is heated by means of five distinct rings of gas-jets, each controlled by a separate tap, so that from one up to five rings can be going at once, according to requirements. If these are pretty constant, two or three rings can be kept regularly working. Up three flights of stairs is a copper cylinder fixed in another cupboard against the wall of a room. Above the cylinder, is a small cistern provided with a ball-cock on the town water supply. Lead pipes convey the water from this cistern to the bottom of the cylinder, and also to the boiler; and a return pipe brings back the heated water from the boiler to the top of the cylinder. Another lead pipe takes the hot water from near the top of the cylinder to all parts of the building where hot water is required; and in this way an abundant supply of almost boiling water is always at hand, whenever and wherever wanted. This apparatus has now been in use for twelve months without giving the slightest trouble.

It could be easily arranged for heating rooms by a system of hot-water pipes or radiators; and in large shops and offices where it would be difficult or undesirable to instal gas or coal fires, it would be a decided boon in the winter, as it is absolutely safe,

gives off no smell, makes no noise, and is always ready at a moment's notice.

Another field of usefulness which awaits development is in the direction of gas-heated boilers or set pots for washing domestic clothes. These are so cheap and convenient, that some architects and builders are putting them into cottages and houses instead of the old-fashioned boiler heated with coal; and some go-ahead gas companies are letting them out on hire. Other undertakings even go so far as to supply gas-engines on hire or the hire-purchase system, and derive considerable benefit from this system.

Gas-Engines.

I think we are all agreed that the use of gas for the production of power is one of the most important subjects we can consider. We have no more profitable outlet for our production. It increases our day and summer consumption, and reduces "the peak of the load" better than anything else; and we are all of one mind that everything should be done to encourage and retain this important branch of business.

I do not know whether my experience has been peculiar; but I have had considerable trouble with gas-engines, which I have found to be due to the uneven heating of the ignition-tubes which have now become pretty general. To illustrate my meaning, I will take an ordinary winter's day. Then we all have to increase our pressure before breakfast, reduce it again at daylight, increase it again at dusk, and finally reduce it once more at midnight. Now if the gas-engine attendant adjusts the flame round his ignition-tube to suit the pressure before breakfast, he would find that his engine after breakfast would be running slow, and that loud reports would perhaps be taking place. This would be due to the ignition-tube having got too cold to properly ignite the charge in the cylinder. When he discovered this, he would open his tap wider; and then when we put on the night pressure, his flame would tail up above the tube. This he could not fail to notice, and so would turn the tap down; and when we took the pressure off again, he would not be aware of anything wrong until he found his engine going slow once more, and loud reports perhaps recurring.

This trouble became acute at Wakefield with a consumer who ran his engine night and day; and it took me some little time to ascertain the cause and find a remedy. This, however, I at last discovered to be to fix a governor on the pipe to the ignition-tube, which keeps the supply of gas uniform to the ignition-tube, no matter what variations of pressure occur in the gas supply, and so obviates all trouble. I have since had to do this so frequently to cure complaints from gas-engine users at Wakefield that I have come to the conclusion that all manufacturers of such engines ought to make a governor on the pipe supplying gas to the ignition-tube a part of their regular outfit. It would also be well for gas-engine makers to devote some attention to the improvement of their ignition-tubes, as in my opinion they are the weak point about these extremely useful machines.

Competition.

The gas industry in the future is likely to have to face much keener competition than it has hitherto had to meet. The competition of rate-aided municipal electricity is yearly increasing in intensity; and we may be thankful that the attention which has been directed to the evils of municipal trading, combined with the increasing difficulty experienced by corporations in obtaining cheap money, is likely to check to some extent the modern Municipal Juggernaut which seemed likely at one time to crush all private enterprise out of existence. It is a monstrous injustice for a municipality to take away the business from a gas company by selling below cost price on the one hand, and then make the company help to pay for the loss on the transaction by means of inflated rates on the other. Sir George Livesey deserves the thanks of the profession for putting a spoke in the wheel of this municipal piracy by means of the famous Bermondsey Clause, which prevents that particular Municipality from selling electricity below cost price, and forms a most useful precedent.

In Wakefield, we have a keen competitor in the Corporation electric light works. The charge for current for ordinary lighting purposes is 4½d. per unit; while our charge for gas is 2s. 6d. per 1000 cubic feet. The relative values of the two commodities at these prices is as follows.

Incandescent gas, taken at the moderate rate of 30 candles per foot per hour (40 candles per foot being not uncommon), would give 30,000 candle-hours for 1000 cubic feet of gas; and as 1000 cubic feet of gas costs 2s. 6d., this equals 1000 candle-hours for 1d. Taking the incandescent electric light at the rate of 4 watts per candle, one unit of electricity would yield light equal to 250 candles, or 250 candle-hours; and as one unit costs 4½d., this equals 55·5 candle-hours for 1d.—in other words, the incandescent electric light at Wakefield is eighteen times as dear as incandescent gas—light for light.

That the figure of 4 watts per candle is a fair one, is proved by the following extract from the Inaugural Address of the President of the Institution of Electrical Engineers, Mr. R. Kaye Gray, delivered on Nov. 19, 1903: "16-candle lamps for 200 volts and upwards, with a life of 1000 hours at an average consumption per candle of even 4 watts, can hardly be obtained as a commercial article." It is astonishing how electricians continue to rate their lamps with absurd extravagance. Wakefield is no exception to the rule; for only last month a statement appeared in the local papers, on the authority of the Corporation Electrical Engineer, that the arc lamps in the city were of from 1000 to 3000 candle power.

We gas men have all along contended that 500 to 600 candles was far nearer the mark; and we are indebted to Mr. J. W. Bradley, the City Engineer of Westminster (a thoroughly impartial observer), for confirmation of our views. This gentleman has been taking actual photometrical observations, by means of an instrument specially constructed for the purpose, of all the different classes of street-lamps in his district, with the result that he finds the electric arcs in Trafalgar Square average 554 candles, those in Pall Mall 585 candles, and those at Hyde Park Corner 563 candles. After these figures, it is to be hoped we shall hear no more of the fiction that electric arcs give a light of from 1000 to 3000 candles.

Another statement which is industriously circulated by electricians is that with the electric light the air of a building is much purer than with gas light. Nothing is easier than to make such an assertion. But it is of no value without proof; and the Corporation of Birmingham took a wise step last year when they called in Professor Percy F. Frankland to thoroughly investigate the matter in connection with the lighting of the Birmingham Museum and Art Gallery by means of gas and electric lights respectively. By carefully analyzing the air in the buildings, this gentleman proved conclusively that it was much purer when the gas was burning than when the electric light was in use, owing to the splendid ventilation which was obtained by means of the heat given off by the gas-lights.

It is not, perhaps, generally recognized that human beings vitiate the air in a building to a considerable extent, and that nothing is so useful to remove the impurities so caused as heat. This is where gas comes in. The heat developed by gas is also useful in cold weather—and it is in cold weather that light is chiefly required—in keeping out the draughts which are invariably found in buildings lighted by electricity, and which are a fruitful cause of colds, neuralgia, bronchitis, and similar troubles.

Other competitors are springing up in various directions. Electricity-in-bulk projects will doubtless introduce into many of the smaller townships and villages a similar form of competition to that at present in operation in the larger towns, as the district and parish councils will no doubt be tempted by offers to purchase electricity in bulk, which they will be persuaded they can sell at a profit—though, as a matter of fact, the profit will very seldom be realized. Then Mond gas schemes will soon be trying to find markets for fuel and power. The stringency of the Money Market will have a tendency to check these enterprises for the present, and will make investors chary about finding the necessary capital for such highly speculative ventures. I cannot conceive how it can possibly pay to distribute, through a costly system of mains, a gas containing about 50 per cent. of inert nitrogen, which can be obtained at every street corner for nothing; and one would think that the uses of this gas, the calorific value of which is only from 150 to 175 B.T.U., and which would be delivered cold to the consumer, must necessarily be restricted.

Twenty years ago, I was much captivated with the subject of gaseous fuel; my idea being, in certain localities where there was a very great demand for power and cheap fuel for industrial purposes, to turn all the coke in the gas-works in those districts into water gas, and distribute it at a cheap rate uncarburetted through a separate system of mains. In this way, I contended that industrial works could obtain power in a cheap and handy form by means of large gas-engines; while a gas of the greatest utility and power would have been at hand for any works which required it. This gas would have contained no inert matter. Its calorific value would have been about 300 B.T.U.; and it would have had a flame temperature of about 1775° C.—some 100° C. higher than that given by coal gas itself. I still think this method would have been far preferable to distributing a gas more than half of which would be useless. At the time I put these ideas forward, there were no large gas-engines; and I strongly advocated their introduction. But now gas-engines of over 1000 brake horse power are in use, and giving every satisfaction.

It would not be difficult to construct a retort-house which would make coal gas for lighting purposes and blue-water gas for industrial purposes at the same time, should they ever be required. Perhaps, however, the time may ultimately arrive when the two gases mixed will leave the retort-house together as a low-grade gas suitable for all purposes, which certainly seems to be the tendency of the times in which we live. In any case, it behoves us to go into this matter very carefully, and see if we cannot retain in our own hands the supply of all gas, of whatever description the locality requires in which our works are placed; and Parliament would be well advised not to be in too much of a hurry to grant facilities for introducing another set of pipes into our already over-burdened streets, which time may demonstrate to have been an unnecessary encumbrance.

Events move nowadays with such rapidity that both electricity-in-bulk projects and Mond gas schemes, before they have got fairly started, are threatened with a powerful rival in suction gas plants, which are now being strenuously advocated by those interested, and from which very economical results are claimed.

Unaccounted-for Gas.

There can be no doubt that one of the most important matters which can engage the attention of gas engineers is the reduction

of leakage. We are in a much better position now for dealing with this question than we were a few years ago, as there are very efficient leakage detectors on the market. Every spring I make it a practice to search for escapes with one of these invaluable pieces of apparatus; and our district being honeycombed with coal workings, we find periodical overhauling is necessary. After stopping all leakages on a length of main, we often discover that the ground continues to subside, and in a few months the joints get drawn again and leak as badly as ever.

Some years ago, I held the dual position of Gas and Water Manager; and I found a very efficient way to reduce the leakage of water was to divide the distributing plant into districts, each provided with a meter, which recorded all the water used in the district. Close inspection of the usual sources of loss enabled the consumption in such a district to be very greatly reduced, and the records of the meter enabled the Manager to keep the consumption down to the normal. I have been hoping to see a meter invented which would give the gas manager the same control over his distribution system; but so far none has yet been devised. If we were able to divide our mains into districts, each controlled by a meter which would allow the gas to pass without reducing the pressure or checking the supply in any way, and which would automatically record the amount of gas passing into that district during all the twenty-four hours of the day, we should go a long way towards reducing our leakage to a very satisfactory point.

Next to broken mains and drawn joints, it goes without saying that the most fruitful source of leakage is defective service-pipes. In some parts of the country, very great care is taken in laying these pipes. They are placed in wooden troughs and covered with pitch, which is no doubt a good plan. I have known towns where the holes in the mains for the service pipes are simply cut with the chisel, and then a rimer and tap inserted. Many of us have to suffer from such practices in the past. It is almost impossible to get a satisfactory connection with the mains in this manner, as a man cannot be depended upon to cut the hole perfectly round with a chisel, no matter how skilful he may be, and leakages are bound to occur.

Some excellent results were published last year showing how one gentleman had got his unaccounted-for gas down to the extremely low figure of 1·06 per cent. In this case, wrought-iron service-pipes, not coated with pitch or any other special preservative, were used; so that it would not appear that special precautions were indispensable, nor that it is necessary to use lead service as practised in some towns. One source of leaky service-pipes is the use of different makes at the same time. Although the tube makers work to one standard thread, there is a considerable divergence between the sizes of different makers' tubes; so that if the pipes of one firm are used with the fittings of another, the connection between the two is rarely perfect. Another cause of trouble is leaky diaphragms in dry meters. Consumers have such a rooted aversion to wet meters that dry meters are, as we are all aware, coming more and more largely into use; and in my own case, I make it a rule to insert new diaphragms into nearly every meter we repair. This keeps them up to the mark, and is, I think, a wise precaution.

Defective gasholder crowns is another source of leakage. Most of us have holders in use to which extra lifts have been added from time to time; and it is the usual practice in such cases to cut off the outer row of crown sheets and to use the old crown again, riveting it to the new outer row of crown sheets and making what was the top lift the middle lift, and so on. Now, the rivet holes get torn and distorted when the old rivets are cut away, and it is almost impossible to make an absolutely perfect joint to the new outer row of crown plates. I have tried many methods of making these joints tight, and have found that the best way is to carefully caulk them with a suitable chisel, locating the leaky rivets by means of soap and water. But I have come to the conclusion that it is a mistake when adding other lifts to holders to use the old crowns. The amount of gas which is lost through leakage in the course of years would pay for an entirely new crown over and over again; and I am of opinion that it would be wiser in the first instance to discard the old crown altogether, and provide an entirely new one instead.

Naphthalene Troubles.

We have had many remedies suggested for the prevention of naphthalene deposits, and await with considerable interest and curiosity the result of the investigation into this question by the Committee of the Southern District Association. I am happy to say that at Wakefield we have had very little trouble with naphthalene for a considerable period. We are now trying the Sheffield antidote, and keep the temperature at the outlet of our condensers at from 80° to 90° Fahr. Our gas then passes to the exhausters and the Pelouze and Audouin tar-extractor; and we find the latter takes out every trace of tar, no matter how high we get the temperature at the outlet of the condensers. The only trouble we have had for some months with naphthalene has been in the lamps, when a hot, sunny day has been followed by a cold, misty night. I have adopted the practice after such a day of putting on the benzol carburetting plant after midnight. Very little benzol is required, as there is so little gas being consumed at this time of night, while every lamp is in use; so that the benzol has a capital chance of clearing away the obstruction. I have found it best to enrich the gas during this operation to 20 or 21 candles for one or two hours. This has proved a capital and inexpensive remedy for a serious nuisance.

Calorific Values.

The importance of calorific value in the gas we supply has come to be generally recognized during the past few years; and we are all indebted to Professor Lewes for the valuable information he gave us on this point in his brilliant lecture before the Institution of Gas Engineers last June. There can be no question that we shall in the future have to aim at producing a gas which will have a good calorific value as well as a good illuminating power. Professor Lewes showed, however, that it was a very difficult matter to regulate the two things. They do not seem to run well in double harness. Different coals which give similar illuminating values give very different calorific values. This seems to point to the necessity of being on our guard against being handicapped by legislation based on calorific values. It is all very well to aim at producing a gas which shall have high calorific value as well as good illuminating power, and quite another matter to be subjected to vexatious analyses by the usual over-zealous bureaucratic examiners, and mulcted in fines for what is an almost impossible task in the light of our present knowledge.

In this, as in most other matters, it is best to proceed slowly; and our industry will be well advised in resisting to the uttermost any attempt on the part of Parliament to introduce calorific restrictions in addition to those we already suffer from.

Parliamentary Procedure.

During the last session of Parliament we had several opportunities of seeing the many imperfections of parliamentary procedure as applied to Private Bill Legislation. We had the painful spectacle of several important Bills which had passed a Committee of one House of Parliament thrown out by a Committee of the other House, or so mutilated as to be useless. This led, in the case of the Crystal Palace Gas Company, to the Bill being withdrawn, and perhaps between £3000 and £4000 thrown away, besides the anxiety, labour, and trouble incidental to the preparation of a Bill for Parliament. The glorious uncertainty of applying to Parliament for a Bill leads one to think that a radical change of procedure is necessary. For instance, why not refer Private Bills to a combined Committee of both Houses of Parliament; the members being specially selected for their knowledge and aptitude for this kind of work? This would reduce by half the expense, worry, and uncertainty of the present method, which is little better than gambling for enormous stakes.

Labour Problems.

In dealing with large bodies of workmen, it goes without saying that a considerable amount of judgment and tact are required. The manager must set a pattern of devotion to duty, and a high standard of conduct for his men to follow. He must, in his dealings with them, be absolutely just, and try to look at both sides of every question which may arise before coming to any decision.

Some of us have considerable difficulty in getting our men to turn up to work on Sundays, bank holidays, &c. This trouble, if not handled properly, gets worse and worse. Much of the unpleasantness is caused in the following way. A stoker, we will say, stops away from his work one Sunday, without leave. The next day he turns up as usual. If there are plenty of men available, he will very likely be sent back again; but if the management is short-handed, he will perhaps be allowed to start work. The next Sunday, seeing this man get off so easily, two stop away; the next, three; and so on. Then, to keep the works going, all the labour falls on to the steady men who will stick. I have known plenty of foremen who work these willing horses almost to death. This is most unfair, and is certain to ruin the health of the strongest men.

This class of foreman also has a knack of losing his temper, and awarding the heaviest punishment for a comparatively trivial offence and then when his temper has cooled down forgiving the culprit altogether. This sort of thing is subversive of all discipline. Human nature is a very weak piece of machinery, and requires careful handling. I have found the best way to deal with men is to take this weakness duly into account, and only demand a very easy standard of conduct; but, having fixed upon this minimum, to adhere to it with stern inflexibility. To illustrate my meaning, I will give the rules in force in Wakefield.

(1).—Any stoker wishing to be away from work must get leave from his foreman at least two hours before the time he should commence work, so that arrangements may be made for filling his place.

(2).—If any stoker shall absent himself from any shift to which he is attached without first obtaining leave from the manager or the foreman in charge of such shift, he shall, for the *first offence*, be duly cautioned by the said foreman. Should he again absent himself without leave, the said foreman shall have power, for the *second offence*, to suspend him from work for 48 hours; and should he be again absent without leave, the said foreman shall have power, for the *third offence*, to suspend him from work for six clear days. Should he once more absent himself without leave, he shall, for the *fourth offence*, be liable to instant dismissal; and such dismissal need not be in writing.

(3).—Should any workman absent himself from work through illness, the manager or foreman may demand the production of a certificate from a duly qualified medical practitioner, certifying to the fact that such workman was at such time incapacitated from following his employment. Should the certificate substantiate the workman's statement, the Company will bear the cost of same; but should it not do so, the cost shall be borne by the workman.

Once each year all back reckonings are wiped off, and we start with a clean slate.

Now these rules sound extremely lenient; and so they are. But I find that only the very steadiest men can live up to them. The result is that I hardly ever have any trouble with my stokers, on Sundays, or bank holidays, or any other time. They turn up with the greatest regularity, while the very same men treated in a different way before my time used to stop off wholesale, and my predecessor has had to stoke himself to keep the works going. The same thing has happened in three other works in different parts of the country of which I have been in charge; so I feel satisfied that it is the system, and not the men, which is responsible for the result.

I have often had foremen who want to make an exception in favour of some particular steady workman, who, however, has infringed the above rules; and they have also wished sometimes, when short handed, to overlook a trivial offence. But I always insist upon the rules being carried out, at no matter what inconvenience; and I am quite certain that the best way to deal with men satisfactorily is to frame rules as easy as possible, and carry them out with inflexible resolution. The men then know what to expect; and the manager can count upon trustworthy services.

While upon this topic, I may say I have often felt proud of the splendid way in which English workmen will pull themselves out of a tight corner. So far as my own experience goes, no other nation can touch us in this respect. The genius of the English people is best shown in beating off a lea shore in the teeth of a gale. No other nation has to such an extent this splendid quality of grappling with, and overcoming, adverse circumstances. But with all his other good qualities, the average Englishman is an untidy person. As a nation, we have the bump of order very poorly developed. I think we all like to go over a works where there is a place for everything and everything is in its place; and I have often been struck with the fact that the best results are frequently combined with the best order in gas-works. My official life, however, seems to have been a constant struggle with disorder. In every works of which I have been in charge there has been the same slovenliness to contend with, and if possible overcome; and it is astonishing how long it takes to get the ordinary working man into orderly habits. He has very little respect for the old adage that "Order is Heaven's First Law."

Stoking Machinery.

The past year has been prolific in invention for charging and drawing retorts. We have had the French electric turbine charger and discharging ram now in use at La Villette station of the Paris Gas Company, and which will soon be installed at Beckton and at the works of the Sutton, Southcoates, and Dryport Gas Company; the delightfully simple centrifugal charger invented by M. De Brouwer, which is in use at Derby and at Walsall; and the combined charger and discharger of Messrs. Fiddes and Aldridge. In the first and last of these types, a very important feature is the discharging ram for pushing out the coke from the retort.

I have not had the advantage of seeing either of these machines in action; but I have seen the De Brouwer, and I was charmed with the ease and speed with which horizontal retorts, 20 feet long, could be charged with this beautifully simple and ingenious apparatus. The one thing wanting to complete it is an efficient ram; and I am very pleased to see that at Derby Mr. Bell has introduced the discharging ram in connection with his De Brouwer charger. With a De Brouwer charger on one side of the retort-house to charge the retorts, a ram on the other side to push out the coke, and a conveyor to remove the latter from the retort-house to the coke heap, the perfection of carbonizing would be within measurable distance.

It would perhaps facilitate the work of the ram if the retorts were set at a slight angle (say) 2 or 3 degrees. This angle would, I think, be no difficulty for the charger to overcome, and then I think we should get all the advantages of the inclined retort system without any of its disadvantages. At Wakefield, as I stated in the paper I read when the Institution did me the honour of inspecting our works, we went in for inclined retorts because it was at the time the only method by which the coke could all be taken out on one side of the retort-house; it being impossible, owing to the peculiarities of our site, to take it out on both sides. Now, with the De Brouwer charger and a ram to push out the coke, it would all come out on one side, as in the inclined retort system. The advantage of doing the work in this manner would be that all sorts of coal could be used, as I saw the De Brouwer charge 20 feet retorts first with screened coal, then with nuts, and, lastly, with smudge. This is an important point. In my opinion, the system which enables us to use the cheapest and commonest coal is the one likely to survive as the fittest, as it broadens the base of our market for raw material.

In the midst of so much invention it is difficult to forecast the future. Whether inclined retorts, horizontal retorts charged by one of the previously-mentioned chargers, with a ram to discharge the coke and a conveyor to remove it, is to be the acme of perfection, or whether the vertical retort of Messrs. Settle and Padfield will eclipse them all, time alone will show. With the latter apparatus, it is claimed that gas of from 6 to 8 feet per pound of coal is obtained, with a good yield of hard coke at the former figure, but no coke of commercial value at the latter, and no tar at either, or a yield of gas 25 per cent. more than by the orthodox methods, with a nearly equal increase in sperm value and with a yield of coke of from $\frac{1}{2}$ to 1 cwt. more per ton of coal carbonized, but with no tar. Whether these results will be obtained in actual practice on a large scale remains to be seen; but happy is the engineer who can afford to wait until these various processes have stood the test of time before being obliged to carry out any large extensions of carbonizing plant.

Insurance.

The question of insuring our works against fire or explosion is one that should receive the careful attention of the prudent gas manager. Good sound insurance companies nowadays undertake this class of risk at such comparatively easy rates, that I think it extremely advisable to make liberal arrangements of this character. True, many undertakings—Wakefield among them—have insurance funds of their own; but I think it judicious to insure with some reputable companies, in addition to this provision. Every gas-works should, in my opinion, be provided with efficient appliances for extinguishing any outbreak of fire which may occur; and men on each shift should be trained in the use of the same, for it is emphatically true of fire that "A stitch in time oft saves nine." At every well-appointed gas-works, there is a splendid fire extinguisher in the ammoniacal liquor stored in the tanks. Steam-pumps are already coupled up to these tanks in most works; and nothing could be easier than to fix the necessary couplings on the delivery-pipes from these pumps to take the fire-hose. Thus the works could be splendidly protected, with very little trouble or expense, in addition to the usual hydrants and the appliances of the local fire brigades.

There is also the third-party risk, as it is called, which has become much greater since the introduction of slot meters and the advent of electric tramways. For instance, suppose a fitter in putting a slot meter and fittings into a house leaves a leakage which results in the premises being burnt down, or suppose a service gets eaten through with electrolysis and the escaping gas finds its way into a dwelling, and an explosion results. These are both third-party risks, which I think it prudent to insure against. The rate for this class of insurance varies with the size of the town, as the risk naturally increases with the density of the population. For instance, if the population of the district supplied with gas is 20,000 and under, the rate is 25s. per cent., if 20,000 to 50,000, 30s. per cent.; if 50,000 to 100,000, 40s. per cent.; and if 100,000 to 200,000, 60s. per cent. These are heavy rates, and will in the future doubtless be reduced, as the system extends and experience accumulates.

Then there is another form of insurance which is not so well known. Some progressive insurance companies now offer sinking fund policies, so that a gas undertaking putting in a new piece of apparatus or machinery can make provision for its replacement when worn out or superseded. They can even provide for the redemption of debentures or the extinction of unremunerative capital in this way.

At the June meeting of the Institution of Gas Engineers, Mr. Arthur Valon read a suggestive paper on the recoupment of capital, in which he advocated the creation of a special fund to wipe off unproductive capital. The same thing could be accomplished by means of insurance, if this were preferred; and being a revenue charge, it would escape the income-tax. I do not see that any objection could be raised to it in Parliament or elsewhere. There would, of course, be the risk of the insurance company failing to meet their engagements; but if the policies were divided among several strong companies, this risk would be comparatively small. Insurance is a subject which would well repay close investigation by some of the more expert accountants among us.

Affiliation with the Institution of Gas Engineers.

At our meeting at Halifax in November last, a letter on "Affiliation with the Institution of Gas Engineers" was read from the Secretary of that Institution. After a short discussion, it was resolved "that no action be taken by the Council without first submitting any proposal that might be made." This question has since that meeting been twice carefully considered by your Committee; and the following resolution passed, as stated in the Committee's annual report, which has just been read to you: "That the Committee of this Institution is prepared to recommend the members of the Manchester District Institution to become affiliated to the Institution of Gas Engineers, subject to the scheme being workable and of general advantage to the gas industry, and would suggest that a Sub-Committee of the Institution of Gas Engineers be formed, and co-opted with the Presidents of the eight District Institutions to consider the question and formulate a scheme."

This resolution came before the Council of the Institution of Gas Engineers on Thursday, the 11th inst., and was practically adopted; a resolution being passed to refer the question of affiliation to the Special Committee which already has this and similar matters in hand, co-opted with the Presidents of the eight District Institutions. Personally, I am strongly in favour of affiliation, believing that the stronger we can make the parent Institution the greater will be its influence when called upon to voice the opinions and desires of the gas industry. Affiliation is an accomplished fact in the case of the representative Institutions of other industries. For instance, the Society of Chemical Industry has ten Local Sections in operation, and the Institution of Electrical Engineers has six in the United Kingdom and two abroad.

In connection with the gas industry, there are eight District Associations in the British Isles, including our own, which are eligible to become affiliated with the parent Institution, with a total muster of 858 members, 11 associate members, 48 associates, 82 extraordinary members, and 8 honorary members, or 1007 altogether. I am of opinion that the Council of the Institution of Gas Engineers should take a very broad-minded view of the requirements necessary for affiliation; for it will be very difficult to bring the District Associations exactly into line with the central body, containing as they do 11 associate members, 48 associates, 82 extraordinary members, and 8 honorary members; and any attempt to do so would, in my opinion, completely wreck all chances of affiliation. However, with the exercise of tact and diplomacy, and the spirit of compromise, it should not be an impossible task to bring affiliation within the range of practical politics.

In conclusion, it now only remains for me to thank you for the patience with which you have listened to my rather discursive remarks, and for all of us in our several spheres to do our best to make coal gas the handmaid of the community. Difficulties will doubtless abound. But difficulties are opportunities to the capable; while opportunities are difficulties to the incapable.

At the close of the address,

Mr. S. Meunier (Stockport) said he was sure the members would join heartily with him in passing a vote of thanks to the President for his interesting address. He had gone to the ledgers of his past experience, and had drawn out of the pages hints for their guidance and points for their study. He noticed that Mr. Townsend started by rather deploring the fact that a President had the task before him of preparing an address. He did not think the task had been one that was very difficult for their President; and the result certainly showed that he was having a joke at their expense. He (Mr. Meunier) was hoping that, by this time next year, the affiliation scheme would be through, because one of the effects of that, he understood, would be that Presidents of the District Associations would not be required to read an address. (Laughter.) A point which would be rather interesting to them all to watch would be the absolutely different line which their President suggested with regard to free services and dealing with the consumers from that proposed in another presidential address which he (Mr. Meunier) had heard earlier that week. In the one case Mr. G. Helps, the President of the Midland Association, advocated furnishing a free supply at the consumer's premises—he meant at the main—in order to cheapen the price of gas, and so enable the gas supplier to sell more, leaving the consumer to pay the remainder, because he considered it was unfair that the large consumers should have to pay a proportion of the expenses attaching to the small consumer. Their own President's suggestion was rather the other way about, to supply every consumer absolutely free, and get him to use more gas. Mr. Townsend believed it would increase trade; but it would cost him rather more. It would be interesting to see which of these two schemes came out best.

Mr. J. H. Brearley (Longwood), in seconding the motion, said that some of them were rather inclined to sympathize with their Presidents. What with the multiplication of Associations, it seemed to be more and more a difficult matter to strike on something that was quite new to place before the members. Mr. Townsend had given them a lot of facts, which it would be worth thinking about. When the members saw the length of the address, some of them were inclined to heave a sigh; but after having listened to it, he felt quite sure they would regret that sigh. The address had been to him entertaining, and would, he had no doubt, be profitable.

The motion was heartily agreed to.

The President thanked the mover and seconder very much for the kind expressions they had been pleased to use, and the members for their cordial endorsement. If the few discursive remarks he had put together had been interesting, and would be of value to anybody, he was amply repaid.

THE PAPERS.

A Vigorous Attack on Inclines and Manchester Machine Working in the Discussion.

The President said as copies of the papers had been circulated among the members, it was proposed on this occasion—more particularly as time was short—to take the papers prepared by Mr. J. G. Newbigging and Mr. Kendrick as read; but, at the same time, they would ask both gentlemen to direct attention to the main points.

Mr. J. G. Newbigging (Manchester) said he thought the Committee were to be commended for adopting the plan of sending out copies of the papers before the meeting. He believed that they did it formerly, but it was only to a select few. It would enable them to have better discussions on the papers—whether or not to the advantage of the writers he did not know; perhaps in some cases it would not be. When he was asked to read a paper, and having decided on the subject, his first idea was to get information from his brother engineers in various parts of the country who were working inclined retorts and horizontals with machinery, and tabulate the replies for reference in the paper. But knowing what a nuisance the circular business was, he decided it would be far better if he merely gave his own experience, so that each engineer could place his figures opposite his (Mr. Newbigging's) for comparison. He then drew attention to the features of his paper, which was as follows:—

HORIZONTAL v. INCLINED RETORT INSTALLATIONS, WITH NOTES ON COKE CONVEYING.

Having recently had to consider the question of the reconstruction and extension of the carbonizing plant at one of the gas-works under my charge, I thought it would be a favourable opportunity to place before you some of my experiences, and describe the work I have undertaken.

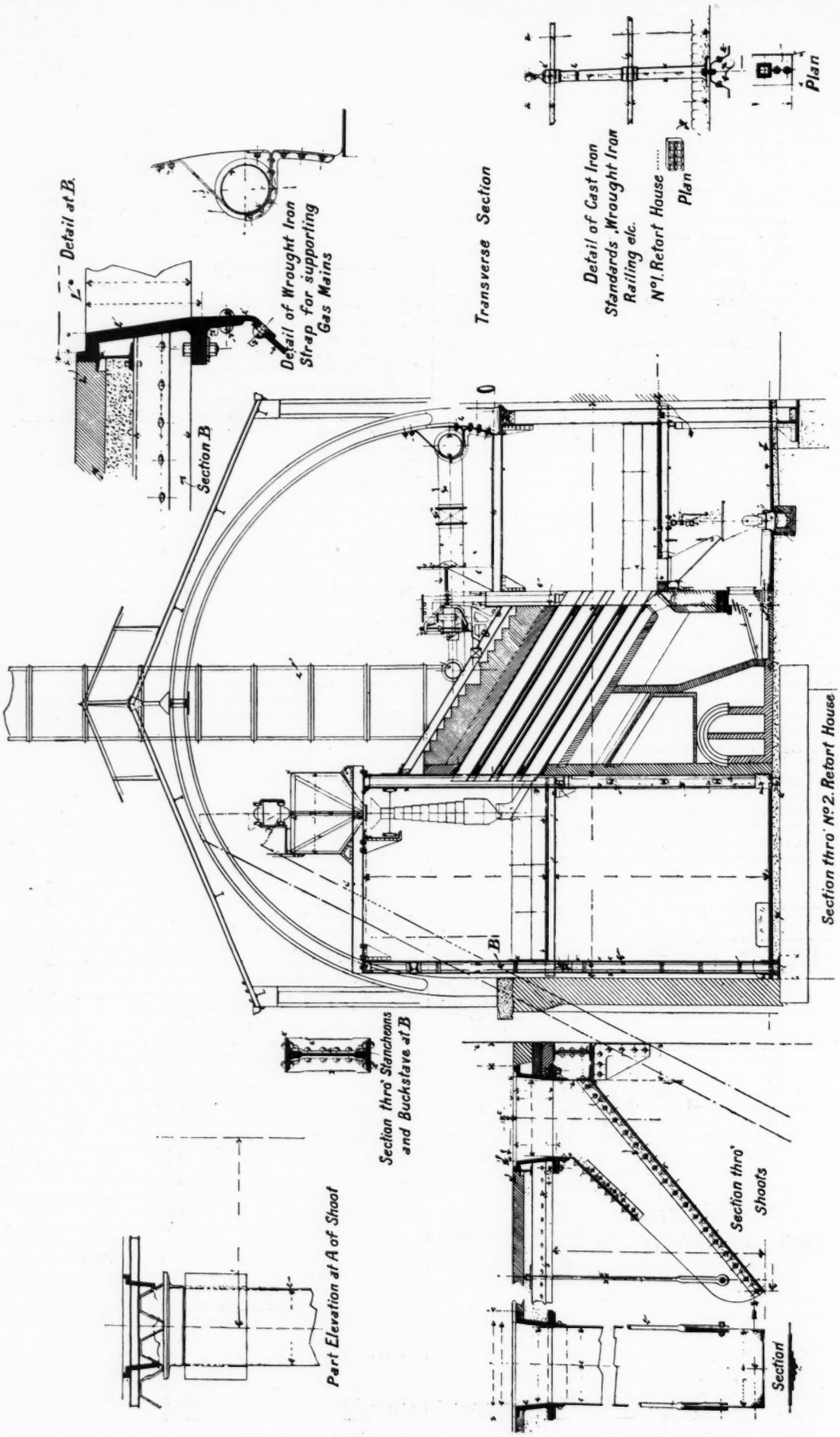
Whenever extensions or reconstruction of carbonizing plant are required at a gas-works, the engineer in charge of the work is confronted with the problem as to which system he shall adopt—inclined retorts or horizontal retorts with a system of power machinery; and as time goes on, the problem becomes more difficult of solution. The engineer of a small works is in even a worse position than one who has a large works under his charge, because in the case of the former, his carbonizing plant consists of one retort-house, whereas the engineer of a larger undertaking has a number of retort-houses under his control, some of which may be working under the one system and some under the other. He is able to judge by the experience thus gained which is the better system to follow when undertaking the reconstruction or extension of his carbonizing plant. The engineer of the smaller works, on the other hand, has to depend to a very great extent on any information he may be able to obtain from other quarters, which is often of an unsatisfactory and unconvincing character.

The introduction of inclined retorts has spurred on those interested in the development of the machinery used for drawing and charging horizontal retorts to still further improve and perfect their machines—machinery which I must say, from my experience of its working, is as well-nigh perfect as mechanical devices can be. In this connection, I may mention the combined drawing and charging machine lately introduced by Mr. John West, and the Parisian turbine and De Brouwer projectors; and as these different appliances have been installed at several gas-works in this country, we shall doubtless have some information in the near future as to their capacity for doing the work of charging the retorts, and particulars of the cost. If the two latter machines are found capable of charging the retorts efficiently from one side of the bench, with English coals, and the difficulty of satisfactorily dealing with the discharging of the coke is surmounted, there will be a very great saving in the cost of carbonizing by their use.

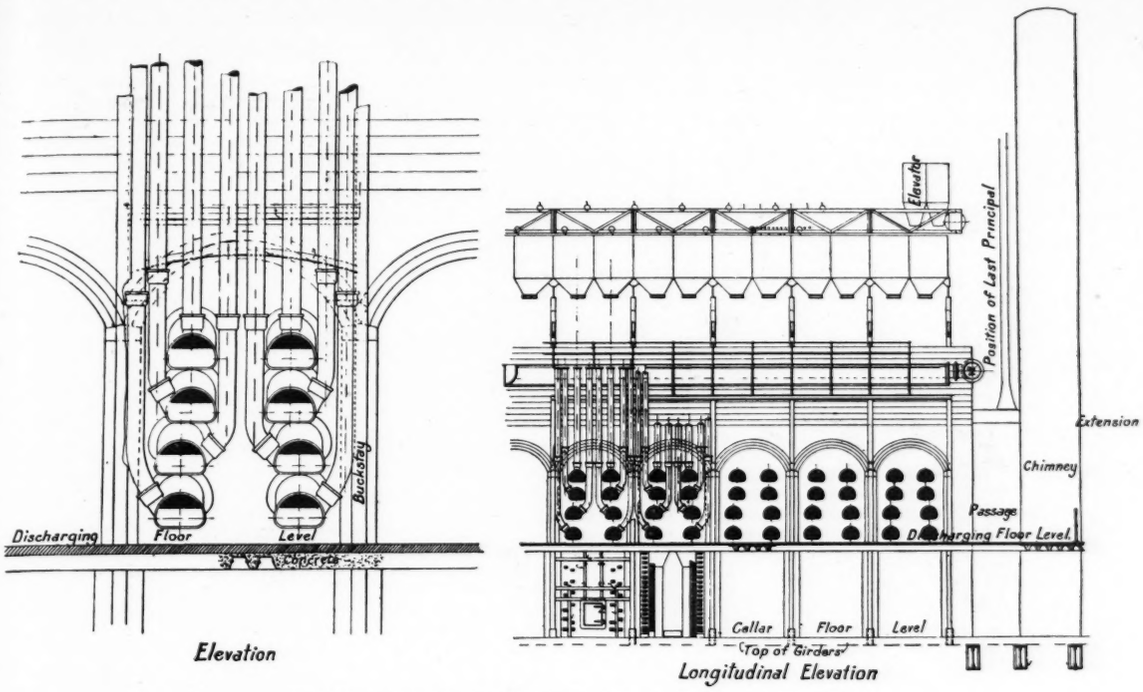
The introduction of these machines has made it still more difficult for an engineer to decide as to whether he shall adhere to horizontal retorts or cast in his lot with the followers of inclines, because these appliances are as applicable to the smaller as to the larger units of carbonizing plant. No wonder, then, that the engineer staves off the extension of his carbonizing plant until the last possible moment, especially as on the top of this keen rivalry between horizontals and inclines for the survival of the fittest, we seem to be on the eve of an evolution to the vertical retort, with heavier charges, and a continuous automatic system of drawing and charging. Until the adaptation of existing power machines, and the introduction of new machines, suitable alike for small as well as large units of carbonizing plant, the majority of engineers naturally looked upon inclines with the greatest favour, as they already fulfilled these conditions. Hitherto the adoption of power machinery was of no advantage where the maximum make of gas per diem was less than a million cubic feet; hence the engineers of smaller works have unhesitatingly adopted inclines.

The question of the available coal supply is an important factor in determining whether horizontals or inclines shall be adopted. We all know that certain coals are unsuited for use in inclined retorts, owing to their tendency to "creep" when in the retort. But if a works is so situated that there is practically no restriction to the selection of coals, the engineer of such a works need have no hesitation in adopting inclines so far as that is concerned. If, however, the works is so situated that only a limited number of coals are available, it is folly to commit oneself to inclines without being previously satisfied that these coals are suitable for use with this form of retort. I mention this because neglecting to give proper consideration to this point has resulted in inclined retorts being unfairly condemned in some quarters as being inferior to horizontals.

In considering the respective merits of inclined and horizontal retort installations, the question of ground-space is one of some importance, especially when works are congested and there is no


Detail at B.
Detail of Wrought Iron Strap for supporting Gas Mains
Transverse Section
Detail of Cast Iron Standards, Wrought Iron Railing etc.
No 1. Retort House ..... Plan
Plan
Section B
Section thro' No 2. Retort House
Section thro' Stanchions and Buckstave at B
Part Elevation at A of Shoot
Section thro' Shoots
Section

DETAILS OF THE INCLINED RETORT SETTING AT THE GAYTHORN GAS-WORKS.

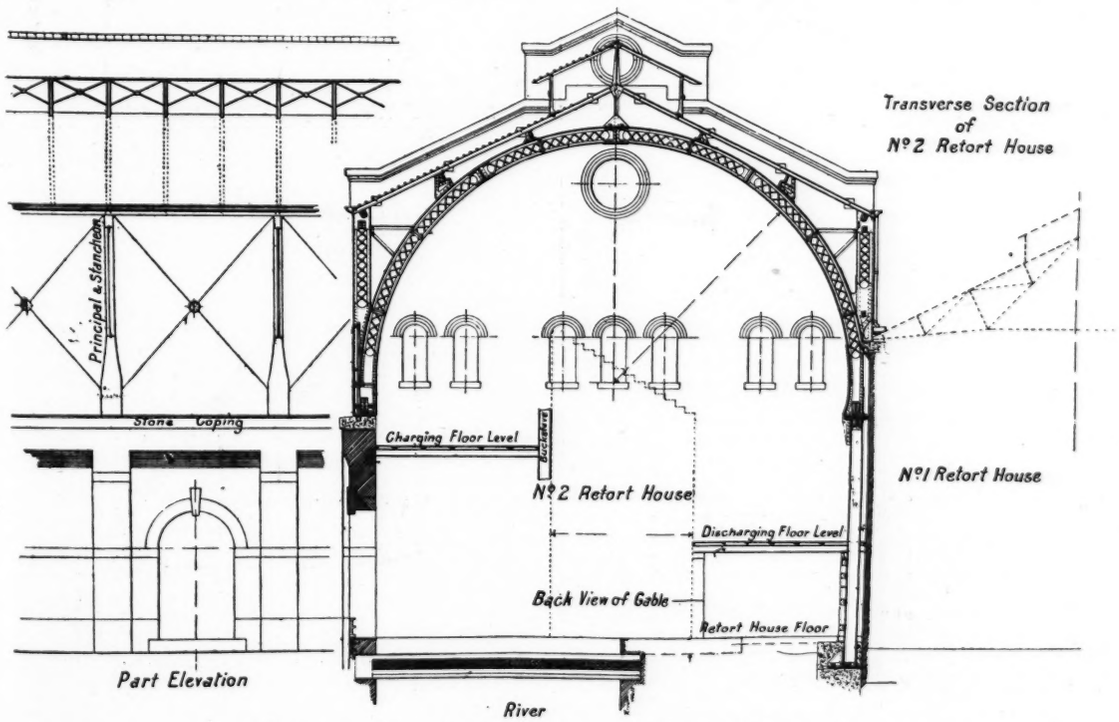


THE INCLINED RETORT-BENCHES AT THE GAYTHORN STATION.

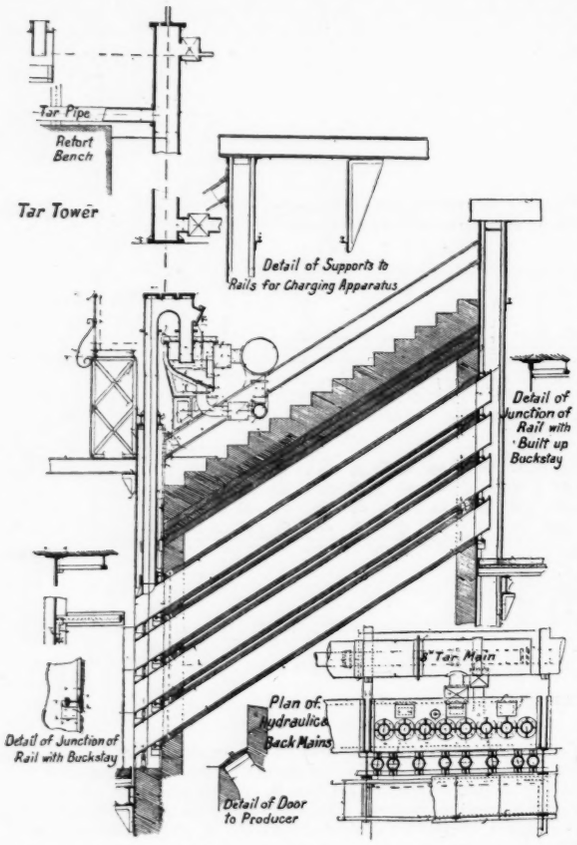
available land for extension. With inclines, the same quantity of gas can be manufactured as with horizontals on about 20 per cent. less ground-space; and when consideration is being given to the conversion and utilizing of an old retort-house to the system, this is of special importance. I have no doubt that in many cases the difference is even greater than this, where very narrow houses have been converted to the inclined system; but in naming this percentage of difference, I am reckoning on a reasonable amount of space between the retort-bench and the walls, on both the charging and drawing floors.

I have made a careful comparison of the respective costs of inclined and horizontal retort installations with machinery which have come under my own personal experience, and find that there is practically no difference between the two; so that any advantage the one system may show over the other must be in the cost of working and maintenance. Taking a carbonizing unit of 2 million cubic feet per day—viz., 144 20-feet retorts—the cost for either the one system or the other would be from £70 to £75 per mouthpiece. These costs are for stage-floor houses, and include everything within the retort-house—viz., drainage and paving of basement, retort-bench, foundations for same, coal elevators and conveyors, ironwork, stage floors, machinery, and chimneys; the walls and roof of the building alone being excluded. These costs are based on the work being substantial and of the highest class in every respect.

In all the papers and articles written on the question of inclined *versus* horizontal retorts, or the discussions thereon, I do not remember having seen any statement made as to the relative cost of the labour and materials in renewing retorts under the two systems. In order to obtain some reliable information on this point, I had careful note taken of these costs during the last retort-setting season, and find that the cost of labour is 137 per cent. greater with inclined retorts than with horizontal retorts. This is accounted for by the awkward position in which the bricklayers have to perform their work; and, consequently, the progress of the work is slower than in re-setting horizontals. The cost of



TRANSVERSE SECTION OF NO. 2 RETORT-HOUSE AT GAYTHORN.


Tar Pipe
Retort Bench
Tar Tower
Detail of Supports to Rails for Charging Apparatus
Detail of Junction of Rail with Built up Buckstay
8" Tar Main
Plan of Hydraulic Back Mains
Detail of Junction of Rail with Buckstay
Detail of Door to Producer

INCLINED RETORT BENCH MOUNTINGS AT THE GAYTHORN STATION.

material is also 42 per cent. greater for inclines than for horizontals—tapered inclined retorts costing 46 per cent. more than horizontals. The following are the details of the figures:—

Cost of Materials and Labour in Renewing a Through Bed of Nine Horizontal Retorts above the Producers.

Labour—			
Taking down ironwork, clearing setting of old material, rebuilding setting, and refixing ironwork	£38	0	0
Cost of labour per mouthpiece	2	2	2
Materials—			
New retorts, firebricks, tiles, &c.	75	0	0
Cost of material per mouthpiece	4	3	4
Total cost of materials and labour per mouthpiece	6	5	6

Cost per square foot of retort-floor area, 6s. 3·25d.

Cost of Labour and Material in Renewing a Bed of Six Inclined Retorts above the Producers.

Labour—			
Taking down ironwork, clearing setting of old material, rebuilding setting, and refixing ironwork	£60	0	0
Cost of labour per mouthpiece	5	0	0
Materials—			
New tapered retorts, firebricks, tiles, &c.	71	0	0
Cost of materials per mouthpiece	5	18	4
Total cost of labour and material per mouthpiece	10	18	4

Cost per square foot of retort-floor area, 10s. 11½d.

From the foregoing figures it will be seen that the cost of renewing inclined retorts—labour and material—per mouthpiece is 74 per cent. greater than in the case of horizontal retorts. Taking the life of the retorts in both systems as 1000 days, and carbonizing equal weights of coal per charge, these costs of renewal of retorts work out to 3·74d. per ton of coal carbonized with inclined retorts, and 2·15d. with horizontal retorts.

As to the durability of inclined retorts compared with horizontal retorts, I have not found that one system shows any advantage over the other. We are able to get an average of 1000 days' work out of both kinds of settings; and I question the economy of working settings, as a general rule, a longer period than that. Certainly towards the end of the life of inclined retorts, the coke requires some little persuasion before leaving them; but I have not found this has been a very serious drawback. There is some diversity of opinion as to whether it is an advantage to have tapered retorts, or to depend upon the form of the cross section of the retort for the easy discharge of the coke. After working both kinds, I find that it is a decided advantage to have a taper of 2 or 3 inches in the length of 20 feet, even though a certain amount of carbonizing space is lost.

In the production of gas per ton of coal carbonized, it is just as easy to obtain a yield of 11,000 cubic feet or over with inclined retorts as with horizontal retorts; and although I have made careful observations, I have not discovered that there is any difference in the production of tar and liquor. The consumption of coke in the producers of the existing inclined retort installation at our Gaythorn Station averages 12 lbs. per 100 lbs. of coal carbonized. This is low, considering the varying quality of coke used, and cannot be surpassed with horizontal retorts. The weight of coal that can be handled with inclined retorts as against horizontal retorts with machinery, is much greater, for an equal amount of physical exertion on the part of the men; and the most striking feature on entering an inclined retort-house is the ease and quietness with which the work is carried on. There seems to be an entire absence of that wear and tear which is so apparent in a horizontal retort-house worked with machinery.

With either inclined or horizontal retort installations, it is an advantage to have stage-floor houses; and it is worth the extra cost, when reconstructing a ground-floor house, to fill up the cellar and start afresh at the ground-line. If the method of discharging coke into waggons is adopted, this is a necessity; and even if some form of coke-conveyor is installed, it is desirable to convey the coke from the retort-house at a height of 10 feet or more, especially if the conveyor is continued on an inclined plane to raise it still higher, in order to discharge the coke into bunkers or deposit it into the yard. The ventilation of the cellars of ground-floor retort-houses by means of fans or shafts, is never entirely satisfactory; and as the more arduous labour is conducted below the discharging floor, it is much better to have stage-floor houses in order that ample ventilation can be obtained. In considering the construction of an inclined installation with a double bench of retorts, the arrangement of having the charging floors at each outer wall, and the discharging of the coke to the centre, is much preferable to the central charging floor. It is true that the former plan is rather more costly; but the comfort in working to the men is worth the extra cost.

The following are the comparative costs of carbonizing with inclined retorts at the Gaythorn station, and with horizontal retorts and machinery at the Bradford Road station.

The cost of carbonizing, maintenance of machinery, and dealing with the coke from the retort-house to the final storing in the yard, are given separately. At the Bradford Road station, the coke is removed in waggons, and at Gaythorn by a push-plate conveyor delivering the coke immediately outside the retort-house into waggons, which are hoisted by a crane and the coke tipped into hoppers or the yard.

GAYTHORN STATION—INCLINED RETORT INSTALLATION.

This house contains 18 beds of retorts, six to a bed, and carbonizes in the 24 hours, with 4 h. 48 m. charges (7 cwt. per charge), 189 tons. The cost of working this house for the three shifts of eight hours each is as follows:—

Labour in Carbonization.

No. of Men.	Occupation.	Rate of Pay per Shift. s. d.	Amount of Wages. £ s. d.
1½ ..	Foremen	7 6 ..	0 11 3
3 ..	Patchers	5 7 ..	0 16 9
2 ..	Enginemen and breakers	4 9 ..	0 9 6
6 ..	Chargers	5 9 ..	1 14 6
3 ..	,, assistants	5 3 ..	0 15 9
18 ..	Drawers	5 3 ..	4 14 6
3 ..	Firemen	5 3 ..	0 15 9
1 .	,, assistant	3 10 ..	0 3 10
2 ..	Cleaning mains	3 10 ..	0 7 8
1 ..	Coal-conveyor	4 6 ..	0 4 6
40½	Total cost of carbonization		£10 14 0

Labour on Coke, including Removal, Elevating, and Storing in Yard.

3 ..	Coke-conveyor and enginemen	4 9 ..	0 14 3
2 ..	Crane drivers	5 0 ..	0 10 0
1 ..	Hooker on	3 10 ..	0 3 10
9 ..	Coke-waggon attendants	4 5 ..	1 19 9
15	Total cost of dealing with coke		£3 7 10

Note.—This cost does not include labour on trimming, when large stocks of coke are held.

	Per Ton o. Coal Carbonized. s. d.
Cost of labour within the retort-house, exclusive of coke	1 1·58
Cost of maintenance of the whole of the machinery, exclusive of the coke-conveyor	0 0·75
Total cost of carbonization	1 2·33
Cost of labour on coke, including removal, elevating, and storing in yard	0 4·30
Total cost of carbonizing, including removal, elevating, and storing coke in yard	1 6·63

	T. c. q. lbs.
Weight of coal carbonized per man per shift.	4 13 1 9
Actual duration of physical labour during shift of eight hours, charging and drawing retorts, and other incidental work	3½ hours.

BRADFORD ROAD STATION—HORIZONTAL RETORT INSTALLATION.

Horizontal stage-floor retort-house, worked with West's drawing and charging machines driven with compressed air. This

house contains 28 beds of retorts, nine retorts to each bed, and carbonizes in the 24 hours, with six-hour charges (7½ cwt. per charge per through retort), 378 tons of coal. The cost of working this house for three shifts of eight hours is as follows:—

Labour in Carbonization.

No. of Men.	Occupation.	Rate of Pay per Shift. s. d.	Amount of Wages. £ s. d.
1½ ..	Foremen	7 6 ..	0 11 3
9 ..	Firemen and two extra fires.	5 3 ..	2 9 0
24 ..	Machine men	5 9 ..	6 18 0
48 ..	,, attendants . . .	5 3 ..	12 12 0
3 ..	Chippers	5 3 ..	0 15 9
6 ..	Patchers	5 7 ..	1 13 6
7 ..	Stackmen	5 3 ..	1 16 9
4 ..	Sweepers and oilers . . .	2 4 ..	0 9 4
1½ ..	Compressed air engineman .	5 3 ..	0 7 10
6 ..	Engine and breaker men .	4 9 ..	1 8 6
110	Total cost of carbonization		£29 1 11

Labour on Coke, including Removal, Elevating, and Storing in Yard.

		s. d.	£ s. d.
24 ..	Coke attendants and quenchers	4 5 ..	5 6 0
4 ..	Horses and drivers . . .	8 6 ..	1 14 0
4 ..	Spraggers	3 2 ..	0 12 8
2 ..	Crane drivers	4 9 ..	0 9 6
2 ..	Hookers on.	3 0 ..	0 6 0
36	Total cost of dealing with coke . .		£8 8 2

Note.—This cost does not include labour on trimming when large stocks of coal are held.

	Per Ton of Coal carbonized. s. d.
Cost of labour within the retort-house, exclusive of coke	1 6·47
Cost of maintenance of the whole of the machinery. .	0 2·50
Total cost of carbonization.	1 8·97
Cost of labour on coke, including removal, elevating, and storing in yard	0 5·33
Total cost of carbonizing, including removal, elevating, and storing coke in yard	2 2·30
	T. c. q. lbs.
Weight of coal carbonized per man per shift	3 8 2 25
Actual duration of physical labour during shift of eight hours, drawing and charging retorts, and other incidental work	4½ hours.

I am quite aware that these costs are less, both in the case of working inclined retorts and horizontal retorts with machinery, at many gas-works; but the conditions of labour and rate of pay differ from those existing in Manchester.

The question of the method of removing coke from the retort-house and storing it in the yard, is an important one in connection with a carbonizing plant, whether on the horizontal or inclined system. The difficulty of dealing satisfactorily with this material by a system of conveyors is very much greater than with coal, owing to its friable and gritty nature. In designing a system, one's object ought to be to so devise it that as little breeze as possible is produced. A standard of 5 per cent. of breeze on the total coke produced should be aimed at. My experience of the push-plate conveyor, and even of the plate-carrying form, is that the cost of maintenance is very heavy, and the life of the plant is very short. They are also prolific producers of breeze, and easily run up the percentage to 15 per cent. of the production of coke. I much prefer the system of discharging the coke direct from the retorts into waggons, and running the waggons into the yard by a system of rope, locomotive, or even horse traction, and then hoisting the coke with a crane and depositing the material into bunkers or the yard. The cost of labour in dealing with the coke by this method is greater than with conveyors; but taking into account the lower capital expenditure and cost of maintenance, and the lower production of breeze, there is nothing to be gained by using conveyors.

My experience of working both systems at one of our stations has been that, in dealing with coke with conveyors (partly of the push-plate and partly of the carrying form), the proportion of breeze on the total coke produced was 15 per cent., as compared with 6 per cent. in dealing with it in waggons. It is only fair to say that the conveying plant in question did not run in a direct line out of the retort-house into the yard. The coke was delivered by a push-plate conveyor into an elevator-boot situated immediately outside the gable end of the retort-house, and then elevated and deposited on to a plate conveyor, which delivered the coke into the yard where required. It was found, however, that the greatest amount of breakage of the coke took place when the coke was trickling from the plate-conveyor into the yard. In the case of discharging a load of from 10 to 20 cwt. of coke from waggons with a crane, it is possible to lower the waggon to within a few feet of the place where it is required to be deposited; and this fact is, of course, the reason for the less breakage.

Having had this costly experience of a complete conveying plant from the retort-house to the final place of deposit in the yard (which, by the way, was installed previous to my entering upon my present position), I am now conveying the coke from this same retort-house with a newer and later form of push-plate conveyor, delivering the coke into waggons or boxes of a capacity of 20 cwt. placed immediately outside the retort-house, which are hoisted with a crane and deposited into hoppers or the yard. As this retort-house is a ground-floor house, it was not adapted for the removal of coke in waggons direct from the retorts.

The following are the comparative costs of removing the coke under two systems:—

Removal of Coke with Waggons and Horse Traction and Storing.

	Per Ton of Coal Carbonized.
Cost of labour, including horses	5·33d.
Interest on capital expenditure on waggons and track, and maintenance of same, taken as 20 per cent. per annum—£500 at 20 per cent. . . .	0·31
Total cost.	5·64d.

Removal and Storing of Coke with Conveying Plant.

Cost of labour	0·90d.
Interest on capital expenditure and maintenance of conveying machinery, taken as 20 per cent. per annum—£3000, at 20 per cent.	3·80
Loss on extra depreciation of coke	2·00
Total cost.	6·70d.

I will now briefly describe the work I have undertaken at the Gaythorn station, which is in course of construction; and photographs of the general drawings of the installation are here for your inspection. Of the four works under my charge, two of them are provided with inclined-retort installations—viz., Gaythorn Station, with 18 beds of six retorts in each, and Droylsden, with five beds of six retorts in each. In both these cases old retort-houses were adapted for the system. At the Gaythorn Station, there is also a retort-house built about forty years ago, which contains 41 beds of six retorts in each, direct fired. This bench having become worn out, besides being costly to work, necessitated consideration being given to its reconstruction; and as we already had an inclined-retort installation working satisfactorily at this station, I decided that this house should be converted to the same system. Another reason that influenced me in this decision was that, with the re-construction of this second house at Gaythorn, we should have a works producing 6 million cubic feet per diem entirely with inclined retorts, and another works—the Rochdale Road station—with a similar production worked entirely with horizontal retorts and machinery. I should thus be in a position to arrive at a very definite conclusion as to the relative advantages of the two systems.

It was decided that, in the reconstruction of this house, the work would be undertaken in two sections, because it was impossible that the entire production of the old house could be spared during the time of transition, which will extend over a period of twelve months. The length of the section now undergoing reconstruction is 200 feet, and the width 60 feet; and this necessitated the demolition of 21 beds of the old direct-fired retorts. Taking the horizontal width of the bench of 20-feet retorts as 17 ft. 2½ in., this leaves a width of 21 ft. 4¾ in. for both the charging and discharging floors. A novel feature of this retort-house is that it is built over the River Medlock—one of the side walls of the house being built on one of the river walls. The river is 30 feet wide; and the covering consists of steel girders, the intermediate space between the girders being arched over with three rings of brickwork, the filling-in of the haunches and the top of the arches consisting of concrete.

The retort-stack will consist of 18 beds of eight retorts, arranged vertically in four tiers; the retorts being 22 in. by 16 in. in section at the charging, and 24 in. by 16 in. at the discharging end. I prefer this arrangement of settings to the eight or nine retorts in three tiers, as there is economy of space, and, however carefully a setting is designed in the case of eights or nines arranged in three tiers, it is difficult to prevent the middle retort becoming overheated as compared with the remaining retorts. In settings of six retorts, or settings of vertical eights as they are commonly called, the heating of the retorts is more even. There is only one disadvantage of this type of settings; and that is the height of the top tier, which, in the case of this installation, is 8 ft. 10½ in. on the charging floor and 7 ft. 10½ in. on the discharging floor. The coke has thus a considerable fall before reaching the waggon in the basement. This objection, however, can be obviated by utilizing the coke from these two retorts for feeding the producers.

The system of charging the retorts which has been adopted is that of the continuous coal storage hoppers with the travelling measuring chamber and adjustable shoots. After experience in other charging arrangements, I consider this is the best. The coal-hoppers are of sufficient capacity to hold twenty-four hours' supply, so that the elevators will only be required to work in the day time. The coal-breakers are fed from overhead coal-hoppers of a capacity of 150 tons. These hoppers are situated underneath the elevated railway; and the coal as received into the works is tipped direct into them. The coke will be removed in waggons and elevated and deposited by a crane into coke-hoppers or the yard, as required.

The main principals of the retort-house roof are built up in sections formed of lattice girders, circular in form and 20 feet apart. On one side of the house, the principals spring off a brick wall, which is capped with a moulded stone coping; the height of the wall from the ground line being 28 feet. On the opposite side, the principals are carried by steel stanchions, fixed against

the adjacent retort-house wall. At the back of each principal on both sides of the house are fixed stanchions riveted to the back of same. These stanchions are for supporting a rolled steel girder running the whole length of each side of house, for carrying the ends of the rafters. The stanchions are braced diagonally by 1⅛-inch diameter bolts, secured to the top of each stanchion and to the bases of principals.

The height from the bases of the principals to the underside of the eaves is 24 ft. 6 in. For a height of 12 feet, this opening is screened with corrugated iron sheeting; the remaining space being left open for the ventilation of the house. The advantage of leaving open sides and screening with corrugated iron sheets, instead of carrying the walls up to the eaves, is that the ventilation can be increased or diminished with facility as may be found necessary when the retort-house is put to work. This form of roof is rather more costly than if the walls had been carried up to the eaves, and a trussed roof adopted; but it is much stronger, and better adapted to stand the hard wear and tear of retort-house work. The extra cost of this roof over a trussed roof is about 9s. per superficial yard of ground area covered.

The height of the roof from the underside of the eaves gutter to the apex is 15 feet. The ventilator at the top of the main roof is 16 feet across by 5 feet high, and is supported by a cast-iron centre and side standards, one opposite each rafter. These standards are braced together diagonally with flat steel; and at the intersecting points are ornamental rosettes. The height of the gable from the ground line to the apex will be 75 ft. 9 in. The total expense of working this new installation will be slightly less than the existing one.

The cost of reconstructing the house, including foundations, river covering, building, roof, retort-bench, ironwork, and chimneys complete, will be £122 per mouthpiece, including plant for dealing with coke. The foundations are very costly, owing to the strong river covering to be provided to carry the heavy weight. The cost of the first installation erected at the Gaythorn station was £142 per mouthpiece, including coke-conveying plant.

The advantages of inclined retorts over horizontal retorts and machinery may be summed up as follows:—

Greater weight of coal handled per man for an equal amount of physical labour.

Less cost of maintenance of machinery.

Saving of 6·64d. per ton of coal carbonized in carbonizing wages.

Against the above advantages of inclines over horizontals, must be taken into consideration the higher cost of renewing the former retorts against the latter—amounting to 1·59d. per ton of coal carbonized. Deducting this from the saving of 6·64d. per ton of coal carbonized in carbonizing wages, leaves a net gain of 5·05d per ton of coal carbonized in favour of inclines. It will, however, be obvious, from the figures given of the comparative duration of labour, that the workman in the inclined retort house has a much easier time than his fellow worker in the horizontal house; and were these conditions equalized, the saving would be greater.

Under present conditions, inclined retorts are the cheaper method of carbonizing. Whether they will continue to hold their own against horizontal retorts, will depend very largely on the successful development of the machinery for charging the latter. No doubt the extension of the inclined system will be somewhat retarded owing to the great hopes held out as to the successful working of electrical projectors, because engineers who have horizontal retort-houses in good condition, and which are now worked at a great cost with hand labour, will hesitate before sweeping these away and supplanting them by inclined retorts, when by introducing machines they may be able to get equally good results with a comparatively small capital expenditure.

Mr. H. Kendrick (Stretford) gave an epitome of his paper, the full text of which was as follows:—

NOTES ON CARBURETTED WATER-GAS WORKINGS.

In placing the few particulars before you that are contained in the following notes, my main idea is to broaden the basis of discussion on Mr. J. G. Newbigging's paper, contrast the cost of producing coal gas and carburetted water gas, and place the details of the latter process before the members in rather a fuller manner than they have appeared previously.

As the details of carburetted water-gas plants are familiar to you all, I shall dispense with any long description of the plant at Stretford, and content myself with the merest outline. My Board, after exhaustive inquiries, adopted the combined type as erected by the Economical Gas Apparatus Construction Company, Limited, and installed one set of a nominal capacity of 500,000 cubic feet per twenty-four hours. All the auxiliary plant is, however, capable of dealing with double this quantity of gas, and also is in duplicate; and the buildings are large enough to accommodate two additional sets of the same size as that now at work. The water-gas plant forms a section of the gas-works complete in itself, and has purifiers, with lime-shed and a meter and house, equal to dealing with a million cubic feet per day. It is, therefore, possible to double the producing capacity of the section at a comparatively small expenditure.

The capital cost of the plant has been as follows:—

Buildings	£3,313
Generating plant, boilers, pumps, blowers, and exhausters	6,342
Relief holder and tank	2,174
Purifiers and house, elevators, and connections	4,564
Meter, meter-house, connections, &c.	1,355
	£17,748
To duplicate the plant, required a generator set, condenser, scrubber, and meter (say)	4,000
Total cost of a million cubic feet per day plant	£21,748

Equal to £10,874 for half-a-million plant.

The capital cost of a coal-gas plant at Stretford, of equal daily capacity, has been:—

Retort-house with stage floor, regenerator furnaces, and manual stoking machinery	£9,466
Condenser	363
Boiler and engine house, with boilers, exhausters, and pumps	988
Scrubber and washer	1,025
Purifiers and house, with elevators and revivifying floor	3,812
Connections and tanks	962
Meter and meter-house	738
	£17,354

The capital cost of the complete plants is therefore, as shown, very much in favour of the carburetted water-gas plant. It has, however, been stated that these plants are invariably put down, and remain for some considerable time afterwards, very much in excess of actual requirements. This statement may be correct in some few cases, when used principally as an emergency gas-producer; but where, as at Stretford and many other works, the plant is an integral part of the manufacturing plant, and solely responsible for the enriching of the coal gas, the case is very different. I have worked out the percentage efficiency based on a yearly make equal to 200 days' maximum make, as a former writer on this subject has done, and basing all my calculations on the efficiency thus obtained so as to contrast the working at Stretford with another set of figures that I have no doubt are still fresh in the memory of many of my hearers.

Stretford Gas-Works.—Carburetted Water Gas.

Six months ended.	Gas made. Cubic feet.	Efficiency. Per Cent.
June 30, 1902	36,097,000	72
Dec. 31, 1902	24,917,000*	50
June 30, 1903	40,718,000	81
Dec. 31, 1903	41,086,000	82
Average for the two years		71·4

* The small make in the December half of 1902 arose from a breakdown, and consequent waiting for the repairing of the plant.

From the foregoing figures, I may therefore claim that the Stretford plant is now being worked nearly as fully as a coal-gas plant of equal capacity, when the usual allowance of 10 to 15 per cent. is made for contingencies; and although the aim of my Board has always been to keep within the recommendations of the Board of Trade Commissioners, and the average quantity of water gas in the gas supplied to our consumers has not exceeded 35 per cent. at any time, yet the coal-gas plant has been taxed to nearly its utmost, and, based upon the same constant, its efficiency has been, in 1902, 90 per cent., and in 1903 95 per cent.

In calculating the capital charges per 1000 cubic feet of gas made, I have, instead of taking the total annual capacity of the two systems, only used the percentage proportions as given above; and the advantages of doing so will all be in favour of the coal-gas plant.

Capital Charges.

Carburetted Water Gas.

£10,874 × 6 per cent. = £652 per annum
÷ 71,400,000 cubic feet = 2·192d. per 1000 cubic feet.
÷ 82,000,000 ,, ,, = 1·908d. ,, ,, ,, ,,

Coal Gas.

£17,354 × 6 per cent. = £1041 per annum
÷ 90,000,000 cubic feet = 2·776d. per 1000 cubic feet.
÷ 95,000,000 ,, ,, = 2·619d. ,, ,, ,, ,,

Showing a saving on capital charges for the two years and six months respectively of 0·582d. and 0·711d. per 1000 cubic feet of gas made.

The experience we have gained at Stretford in working the carburetted water-gas plant, has been of so favourable a character that I shall not have any hesitation in recommending to my

Board its duplication when necessary; and the following figures, which have been extracted from our balance-sheets and ledgers, will amply bear out my optimism:—

Average Cost of Making 20½-Candle Power Carburetted Water Gas.

—	Two Years ended Dec. 31, 1903. Gas made, 142,817,000 Cubic Feet.		Six Months ended Dec. 31, 1903. Gas made, 41,086,000 Cubic Feet.	
	Expenditure.	Cost per 1000 Cub. Ft. of Gas made.	Expenditure.	Cost per 1000 Cub. Ft. of Gas made.
	£ s. d.	d.	£ s. d.	d.
Gas oil (including cartage)	4907 12 10	8·247	1376 1 2	8·038
Coke and breeze	1813 18 2	3·048	510 18 2	2·984
Salaries (proportion)	304 0 0	0·502	84 0 0	0 491
Wages	665 16 8	1·119	177 17 6	1·039
Purifying (materials and labour)	524 19 1	0·883	131 14 0	0·769
Repairs (materials, labour, and water)	802 6 1	1·348	162 1 3	0·946
Total	£8714 12 10	15·147	£2442 12 1	14·267
Deduct tar	318 6 0	0 526	114 0 6	0·642
Net cost of carburetted water gas	£8396 6 10	14·621	£2328 11 7	13·625

	Tons	Cwt.	Per 1000 Cubic Feet of Gas Made.
Coke and breeze used (2 years)	3171	9	= 48·95 lbs.
,, ,, ,, (½-year)	919	5	= 50·12 ,,

Gas oil used (2 years) 428,880 galls. = 3·01 galls. per 1000 c. ft. = 6·81 candles per gallon.

,, ,, (½ year) 118,230 galls. = 2·88 galls. per 1000 c. ft. = 7·12 candles per gallon.

The weights of coke and breeze given include the quantity used for lighting up and burning out the plant. The prices charged in the accounts are the yard prices for the same periods; while the cost of the oil has varied from 4¾d. to 2½d. per gallon—the present price being between the two. During the past six months, an inferior quality of coal has been carbonized, yielding a coke with a greater percentage of ash. This will fully account for the larger quantity used per 1000 cubic feet of gas made; while the reduction in the amount of oil is due to some alterations made last summer in the fixing-chamber, by which the fixing area of the brickwork was increased.

Average Cost of Making 16-Candle Power Coal Gas.

—	Two Years ended Dec. 31, 1903. Gas made, 460,674,000 Cubic Feet.		Six Months ended Dec. 31, 1903. Gas made, 128,535,000 Cubic Feet.	
	Expenditure.	Cost per 1000 Cub. Ft. of Gas made.	Expenditure.	Cost per 1000 Cub. Ft. of Gas made.
	£ s. d.	d.	£ s. d.	d.
Coal	24,850 7 11	12·946	6,224 4 4	11·614
Salaries	786 11 7	0·410	194 11 10	0·363
Wages	6,575 15 6	3·426	1,736 15 0	3·243
Purifying	195 0 11	0·104	105 17 0	0·198
Repairs to works	5,545 2 0	2·889	1,634 6 7	3·051
Repairs to retorts	4,044 13 8	2·107	1,086 10 5	2·028
Total	£41,997 11 7	21·882	£10,882 5 2	20·497
Deduct received for residuals—				
Coke and breeze	6,860 0 1	3·573	2,005 14 8	3·753
Tar	4,089 15 1	2·131	1 608 3 3	3·003
Ammoniacal liquor	2,911 2 10	1·516	591 12 9	1·852
Total	£13,860 18 0	7·220	£4,605 10 8	8·618
Net cost of coal gas	£28,136 13 7	14·662	£6,276 14 6	11·879

The reduced net cost of the coal gas in the December half of 1903 is principally due to the change of quality and lessened price of the coal carbonized, and to the enhanced value of residuals—notably of tar.

It will be admitted by all that with carburetted water-gas plants less land is required than when erecting coal-gas plants for the production of a given quantity of gas. At Stretford, the area of the land occupied by the complete carburetted water-gas section is 3194 square yards; while for a similar-sized coal-gas plant at least 4020 square yards would be necessary. There are very large spaces around the water-gas plant at Stretford which cannot very well be utilized; and these are included in the area given, while the coal-gas figures include the minimum allowance for coal and coke storage. The annual charges per 1000 cubic feet of gas, with a ground rent of 3d. per square yard, will then amount to the following:—

Carburetted Water Gas.

Two years ended Dec. 31, 1903.

3194 square yards at 3d. = £39 18s. 6d. per annum.
÷ 2 × 71,400,000 cubic feet = 0·067d. per 1000 cubic feet.

Six months ended Dec. 31, 1903.

3194 square yards at 3d. = £39 18s. 6d. per annum.
÷ 2 × 82,000,000 cubic feet = 0·051d. per 1000 cubic feet.

Coal Gas.

Two years ended Dec. 31, 1903.

4020 square yards at 3d. = £50 5s. per annum.
÷ 2 × 90,000,000 cubic feet = 0·067d. per 1000 cubic feet.

Six months ended Dec. 31, 1903.

4020 square yards at 3d. = £50 5s. per annum.
÷ 2 × 95,000,000 cubic feet = 0·063d. per 1000 cubic feet.

It is now possible to arrive at the net cost of the two gases; and totalling the cost per 1000 cubic feet due to ground rents, capital expenditure, and the working expenses, we arrive at the following figures:—

Carburetted Water Gas.

—	Two Years ended Dec. 31, 1903.	Six Months ended Dec. 31, 1902.
	d.	d.
Net cost of gas in holder	14·621	13·626
Interest on capital	2·192	1·908
Ground rents	0·067	0·051
Total	16·880	15·585

Coal Gas.

—	Two Years ended Dec. 31, 1903.	Six Months ended Dec. 31, 1903.
	d.	d.
Net cost of gas in holder	14·662	11·879
Interest on capital	2·776	2·619
Ground rents	0·067	0·063
Total	17·505	14·561

In contrasting the total working costs given above, it is necessary to take into consideration the illuminating power of the gases produced; and, accordingly, I have worked out the cost per candle per 1000 cubic feet.

Carburetted Water Gas.

Two years ended Dec. 31, 1903.

$\frac{16·880}{20·5}$ = 0·823d. per candle per 1000 cubic feet.

Six months ended Dec. 31, 1903.

$\frac{15·585}{20·5}$ = 0·760d. per candle per 1000 cubic feet.

Coal Gas.

Two years ended Dec. 31, 1903.

$\frac{17·505}{16}$ = 1·094d. per candle per 1000 cubic feet.

Six months ended Dec. 31, 1903.

$\frac{14·561}{16}$ = 0·910d. per candle per 1000 cubic feet.

From the foregoing statements, it is evident that the more economical gas-making method is the Lowe water-gas process, both from the standpoint of capital expenditure and working results, without taking into account the added advantages of having a plant on hand that can, without any loss but rather a gain in efficiency, readily turn out an additional quantity of gas at a moment's notice; for with us at Stretford it has been the practice, except during the two heavy weeks at Christmas, not to work the plant more than twenty hours per day. We have therefore a margin of four hours make per day in hand (about 90,000 cubic feet) during the remainder of December and the whole of January. The advantage of readily controlling the illuminating power will not be disputed, nor will the partial independence of coal supplies; while the control of the coke market is another tangible matter, as will be seen from the following table of prices received for coke at Stretford during the winter months:—

1894	5s. 0s. per ton.	1899	7s. 6d. per ton.
1895	4s. 9d. ,, ,,	1900	9s. 2d. ,, ,,
1896	5d. 0d. ,, ,,	1901	12s. 6d. ,, ,,
1897	5s. 10d. ,, ,,	1902	11s. 8d. ,, ,,
1898	6s. 8d. ,, ,,	1903	10s. 10d. ,, ,,

The plant was started at Christmas, 1899, but was not put on full work until the end of January; so that the reduction in the quantity of coke for sale was hardly appreciated. There was a considerable rise in 1900; but the rise in prices of fuels all round, and the working of the Manchester Commercial Section, affect the remaining years. So that it is not possible to state a definite gain; but all the same, there has been a better price obtained.

The prices of coke at Stretford have always been to a large extent ruled by the neighbouring Manchester Gas-Works, and Stretford has to a certain extent always influenced the prices at another gas-works close by. But while the prices for coke up to 1899 have been invariably lower than the Manchester rates, since 1899 our prices have invariably been higher than at the Manchester Gas-Works; and our neighbours on the other side have advanced their prices in sympathy with those at Stretford. I think you will agree with me that this is sufficient proof of an improvement which is partly due to manufacturing a proportion of carburetted water gas instead of all coal gas.

It is not possible to express these advantages in pounds, shillings, and pence; but comparing our working expenses with the years before 1899, we find a considerable reduction under the present system, and although we are supplying largely increased quantities of gas, our wages or repairs bill does not increase in ratio. This can be verified by reference to the tables showing that the working expenses are on the whole less in proportion for the half year to December, 1903, than for the two years to December, 1903. Nor is it possible to estimate the money value to a gas undertaking by the employment of a body of men of far greater intelligence than the average gas-works stoker, the lessened number of men of all grades required for carrying on the work of repairs and upkeep, and the benefit to the minds of the responsible heads, when they leave the works, from the knowledge that there is a plant there that will, under any but the most exceptional circumstances, help fill the holders in case of necessity, without the usual formality of waiting several days while the heats are got up.

It might readily be asked if the manufacture of carburetted water gas is so much more economical than coal gas, and possesses all these advantages, why not supply nothing but carburetted water gas? Apart from the sentimental aspect of the case, which appeals so largely to our consumers and particularly to the local councils, the "bogey" of carbon monoxide is a real difficulty; a high percentage not only reduces the heating value of the gas, and alters the explosion proportions for engines, but also induces complaints from the consumers, on account of the relatively smaller area of the water-gas flame, which is always ascribed to want of pressure. A question which wants ventilating, too, is the difference between illuminating power and illuminating effect. In connection therewith, I have taken particular note of the illumination of my house at various times, and have arrived at the conclusion that the greater the percentage of carburetted water gas mixed with the coal gas, the less diffusive is the light produced by the combustion of the mixture, although the illuminating power has been the same. Whether or not this is due to the difference in the molecular composition of the hydrocarbons comprising the illuminating constituents I am unable to say, as I have not the time, even if I had the ability or opportunity, to study this complex question. It is a fact that the percentage of hydrocarbons in carburetted water gas is much higher for equal illuminating powers than in coal gas—due, most likely, to the hydrocarbons in the water gas being derived from a different series to the ethylene series of the coal gas.

Another reason for not extending the use of carburetted water gas unduly lies in the possibility, sooner or later, of the Board of Trade adopting the recommendations of their own Commission and limiting the proportion to be sent out. As already stated, we have endeavoured to keep within the limits there laid down, and find that we can safely work up to about 35 per cent. without unduly affecting either the size of the flame or the calorific power, or interfering with the explosive point. It is possible that, did all gas-works in the country adopt the process or largely increase the proportion of the gas in the mixture as supplied to their consumers, the corresponding advantage to be obtained by the use of cheaper coals and the cheapening of cannels would be more than swallowed up by a sharp rise in the price of oil. We therefore arrive at the definite conclusion that the two systems should be worked in conjunction, and for the coal-gas plant to supply the water-gas plant with fuel, and for the latter gas to supply the enrichment.

During the past six months, we have at Stretford been principally dependant upon the carburetted water-gas plant for enrichment. This has enabled us to reduce the cost of our coals very considerably, as is shown by the figures relating to the six months ending Dec. 31 last. We seem to be buying coals this season as low, or nearly as low, as ever we are likely to do in the future; while it does not appear likely that the price of oil will advance again very materially, unless the coal prices are forced up again as they were in 1900-1. I therefore introduced the comparison between the two years' average and the last half year to bring out the point that, even with cheap coal, carburetted water gas is the cheaper illuminant where used solely for enriching purposes.

As already stated, I have been led to make these few statements by a desire to broaden the scope of the discussion on Mr. Newbigging's paper; but there has been another motive as well. Since the time when one of our members gave us the benefit of his researches in a paper which was smitten hip and thigh, and dubbed "Water Gas: A Romance," I have had in mind some such opportunity as this, as I fully intended to show that the deductions therein contained did not apply to the gas-works I was responsible for. In conclusion, I am pleased to be able to affirm that my opinion of the statement, based on a superficial examination of the subject after reading the before-mentioned production, that the manufacture of carburetted water gas was a costly failure had very little foundation in fact, has been more than amply confirmed by the tables given in the foregoing paper.

At the close of the paper,

Mr. KENDRICK said as the figures Mr. Newbigging had given were not at all to be compared with the smaller works in the neighbourhood, he thought it perhaps desirable, for the sake of those who did not reckon to make gas by the thousands of millions, but by the bare hundreds, if he gave the figures for horizontal retort working by West's manual machines compared with hand labour. Mr. Kendrick then read the following:—

SUPPLEMENT ON SHOVEL v. MANUAL MACHINE CHARGING.

The cost of carbonization at Stretford in regenerator furnaces will not compare with those at larger works; but as the greater number of gas-works in the United Kingdom are much nearer the size of those of which I have charge than where power machines are largely used, I have thought it possible that the figures relating to our working both when using West's manual charging machinery, and when the same ovens were charged by shovel, might be useful for comparison at this juncture.

The Stretford Gas-Works being a Manchester suburban works, the rates of pay and conditions of labour are practically the same as in Manchester and Salford. The labour costs for shovel and machine charging are as follows:—

Shovel Work on Regenerator Furnaces.

	£ s. d.
1½ firemen at 6s.	0 9 0
36 stokers, including coal wheeling and pipe jumping, at 5s. 4d.	9 12 0
1 coal and cannel breaker at 3s. 10d.	0 3 10
1 hydraulic main attendant and pipe jumper at 5s. 3d.	0 5 3
3 firemen at 5s. 3d.	0 15 9
	£11 5 10

Coal carbonized 100 tons per day	= 2s.	3·01d. per ton.
12 coke wheelers at 5s. 3d. = £3 3s.	=	8·44d. ,,
Total carbonizing costs.	2s.	11·45d. per ton.

West's Manual Machines, with Regenerator Furnaces.

	£ s. d.
1½ foremen at 6s.	0 9 0
12 machine men and pipe jumpers at 5s. 9d.	3 9 0
1 hydraulic main attendant and pipe jumper at 5s. 3d.	0 5 3
½ engine man at 4s. 9d.	0 2 4½
1½ breaker attendants at 4s. 4d.	0 6 6
1½ coal wheeler at 3s. 10d.	0 5 9
3 firemen at 5s. 3d.	0 15 9
	£5 13 7½

	s.	d.	
Coal carbonized per day, 89 tons 12 cwt.	= 1	3·22	per ton.
Repairs and depreciation on machines	=	1·62	,,
	1	4·83	per ton.
Coke wheeling		8·44	,,
	2	1·27	per ton.

A difference of 10·18d. per ton in favour of machine charging.

With power machines, the cost of carbonizing should come down, and would compare favourably with the cost of working inclined settings as given by Mr. Newbigging. As, however, it would be impossible to use the same class of coals in inclines as we are now using with the manual machines, the net cost of the working will be affected, and needs a correction as follows:—

Average cost of coal as carbonized, including discharging and stacking	9s. 11d. per ton.
Average cost of nuts in above, including handling	11s. 7d. ,,

A difference of 1s. 8d. per ton; and after allowing for the net saving of 5d. per ton in working the inclines, as shown by Mr. Newbigging, will still show a net saving of 1s. 3d. per ton in favour of horizontal machine-charged retorts. When, however, the yield and illuminating power are allowed for, this difference will be considerably reduced as follows:—

	Cost of Coal per ton.	Per 1000 cub. ft.	Add Benzol.	Per 1000 c. ft. 16-Candle Power Gas.
Manual machines and horizontal retorts	9s. 11d.	11·614d.	0·320d.	11·934d.
Inclined retorts	11s. 7d.	12·991d.	—	12·991d.

Deduct saving of 0·473d. per 1000 cubic feet for inclines = 12·518d.; leaving a net saving of 0·616d. per 1000 cubic feet, or 6·345d. per ton of coal carbonized, in favour of horizontal machine-charged retorts.

I shall, therefore, pin my faith to horizontal retorts for some little time, and watch the development of the Parisian turbine and the De Brouwer projector.

Discussion.

Mr. J. C. BELTON (Chester) said as he had recently had some experience in converting an old-fashioned retort-house into a modern one, the paper by Mr. Newbigging was of peculiar interest to him; and he might say that the problem the author spoke of in his first paragraph was exactly that which faced him (Mr. Belton) when he went to Chester. He made some careful inquiries, and visited several works where inclined retorts were in

use; and the result of the inquiries was to lead him to make up his mind not to have anything whatever to do with inclines for three reasons: Because horizontal retorts with machinery cost less in the first instance; they were less costly in maintenance; and they were more profitable in every way. It was true, as Mr. Newbigging said, a great deal of the information which was given on this subject was often unsatisfactory and of an unconvincing character; and with all respect to the author, he (Mr. Belton) thought the paper Mr. Newbigging had given would bear the same interpretation. It was unconvincing because it left out a great deal of information that ought to be given; it was incomplete, inasmuch as it gave statistics on one side of the argument which were withheld on the other; and it was unsatisfactory on that account. Now how had the introduction of the new inventions they had heard of lately made it more difficult for an engineer to decide as to whether he should go in for inclines, or horizontals? He (Mr. Belton) thought it had made it far easier for an engineer to decide to go in for horizontals, because these machines were not intended to apply to inclines but to horizontals only; and if he could show, as he hoped to do before he finished, that horizontals could be worked even more cheaply than inclines, then the argument was all in favour of horizontals. Coming to the end of the fourth clause of the paper, there was a remark to which he must take exception. It was, that "the engineers of smaller works have unhesitatingly adopted inclines." This he absolutely denied. He was himself an engineer of one of those small works. They made 1,100,000 cubic feet per day in winter, and ran down to 400,000 cubic feet in summer; and he held that the statement in the paper was too sweeping to be consistent with the facts. Engineers had not only hesitated about adopting inclines, but their inquiries had led them to take an opposite course. Then in a subsequent paragraph, the author said: "When consideration is being given to the conversion and utilizing of an old retort-house to the inclined system, this is of special importance"—the "this" referred to the ground space occupied; and in this respect horizontals were said to be inferior to inclines. "With inclines," the author stated, "the same quantity of gas can be manufactured as with horizontals on about 20 per cent. less ground space." If inclines required less ground space, it was not more than 14 per cent. less than horizontals. From figures that Mr. Newbigging had given further on in his paper, it appeared that at Gaythorn he had gone in for settings of eights set in tiers of four. Then Mr. Newbigging made this statement: "I have made a careful comparison of the respective costs of inclined and horizontal retort installations with machinery which have come under my own personal experience, and find that there is practically no difference between the two." This was really an astonishing statement; and he (Mr. Belton) could only suppose that the writer of it had not had sufficient information before him when he made it, from the fact that a statement of the kind was pure nonsense. Not only did Mr. Newbigging admit this further on, when he said the cost of reinstatement was something like 137 per cent. greater than for horizontals, but the whole evidence of practice throughout the country was that the cost of inclines was a great deal more than horizontals in the first instance. The inquiries he (Mr. Belton) made at the time the alterations were about to be effected at Chester gave him something like from £80 to £100 per mouthpiece as the lowest cost for which he must provide for inclines. The alterations carried out at Chester, on the lines that Mr. Newbigging had taken in the paper—leaving out the raising of the walls and the provision of the new roof, but including everything else, from the pulling down of the old plant, repaving the retort-house, and the erection of everything complete within the house—had cost only £64 per mouthpiece. This would compare very favourably with any inclined installation in the country. Passing on, they read that "in the production of gas per ton of coal carbonized, it was just as easy to obtain a yield of 11,000 cubic feet or over with inclined retorts as with horizontal retorts." He should like to ask Mr. Newbigging, if this was so, how it was they did not do it, because in looking at the returns for Manchester for the past year in the "Gas World Year Book," he found that the make of gas averaged only 10,778 cubic feet per ton of coal carbonized from all the works. He did not know how much of that they sold. But with horizontals at Chester, the average make over the past year was 11,052 cubic feet. Then the consumption of coke in the producers of the existing inclined retort installation at the Gaythorn station averaged 12 lbs. per 100 lbs. of coal carbonized. This was useful information, so far as it went. But here they were discussing "Horizontal *v.* Inclined Retorts;" and he thought that in a British Court of Justice, it was the custom to hear the evidence of both sides. He therefore asked why Mr. Newbigging had not given the fuel consumption in his horizontal settings? He should like to ask Mr. Newbigging how he arrived at this figure of 12 lbs. per 100 lbs. of coal. The author said "this is low, considering the varying quality of coke used, and cannot be surpassed with horizontal retorts." He must certainly congratulate Mr. Newbigging on his courage in coming forward with a statement like that. He (Mr. Belton) was not the only engineer with horizontal retorts who could tell him something different. He should be pleased to show to Mr. Newbigging, or to any engineer who cared to go to Chester, that the figure could be superseded, and was being superseded, with properly managed horizontal furnaces. At Chester, the fuel worked out on the whole twelve months to 8·88 lbs. per 100 lbs. of coal.

A MEMBER: How do you arrive at that, Mr. Belton?

Mr. BELTON: It is arrived at by estimating the production of coke at 13½ cwt. per ton of coal, and deducting the sales and the boiler fuel.

ANOTHER MEMBER: It is based on estimate purely.

Mr. BELTON, replying to further questions, said the sale of coke was 11·02 cwt. per ton of coal carbonized. The average quantity of gas made was 11,052 cubic feet per ton; and the make per mouthpiece over the year averaged 8485 cubic feet. The fuel used was 8·88 per cent. on the coal, which was equal to 13·16 per cent. of the coke made. The net sales of coke came to 11·02 cwt. per ton of coal—that was 81·69 per cent. of the coke made; and the boiler fuel was equal to 5·15 per cent. As he had said already, he should be pleased to show any engineer who was sufficiently interested to visit the Chester works, how the figures were arrived at. However, Mr. Newbigging went on to say: "The weight of coal that can be handled with inclined retorts as against horizontal retorts with machinery is much greater, for an equal amount of physical exertion on the part of the men; and the most striking feature on entering an inclined retort-house is the ease and quietness with which the work is carried on. There seems to be an entire absence of that wear and tear which is so apparent in a horizontal retort-house worked with machinery." Well, they, as engineers, were not concerned with what "seems to be." Engineers and shareholders alike were a great deal more concerned with what is; and the fact was that the wear and tear on inclined retorts was equal to, if not far in excess of, that of a carefully worked horizontal system. He was speaking of his own experience with manual machinery. If anyone could go into a quieter house than theirs at Chester, excepting when actual charging and drawing operations were proceeding, he should like to see it. Passing on to the tables as to labour in carbonization, these were very interesting. They gave them information so far as they went; but they were incomplete. There were three points to which he wished to call attention in these tables. The first was the working costs; the second, the duration of labour; and the third, the duration of the charges, which were different on the two systems. He need not go through the tables; but he would give the working costs at Chester, for seven through arches (20 feet), with two 10-feet retorts set back to back, making 19 feet of clear working space inside the retorts, and giving 112 mouthpieces for the seven beds. They employed 22 men; and they carbonized in the twenty-four hours 85 tons 1¾ cwt. of coal. This was the average taken over the whole twelve months. The costs of carbonization—he had taken the amounts exactly as given in the paper—amounted to £5 10s. 8·5d., against £10 14s. in the paper for 189 tons. Of course, he (Mr. Belton) was not comparing the total figure. But the total cost at Chester for wages only was 1s. 3·52d., which included scurfing and patching. The cost of labour in the house, exclusive of coke handling, was 1s. 1·195d. Now giving the same figure that Mr. Newbigging took for his maintenance, which he (Mr. Belton) considered in his case was at any rate amply sufficient—that was 0·75d.—the total for carbonizing only was 1s. 1·945d. As to the cost of labour on coke, all inclusive, he noticed here that Mr. Newbigging mentioned that this figure did not include labour on trimming when large stocks of coke were held. Now at Chester they carbonized 20,000 odd tons of coal in the year, and it was seldom their stock exceeded 2000 tons. But they were safe up to 3500 tons without adding a farthing to the figure he was giving—that was 2·325d. per ton of coal; so that their inclusive cost was 1s. 4·27d. against Manchester's for inclines 1s. 6·63d., and horizontals 2s. 0·55d. There was therefore a difference in favour of horizontals with manual machines and horizontals with power machinery as worked at Manchester, of 8·28d. Now he was prepared to admit that the cases were not on all-fours. There might be differences in the rates of wages, and differences in labour conditions; but he was not prepared to admit that the tables set before them in the paper were any conclusive evidence whatever in favour of the inclined system. At Chester, the weight of coal handled per man per shift worked out to 4 tons 14 cwt. 2 qrs. 6·2 lbs.; and he might say this was exclusive of the scurfers, and included 18 men out of the 22—deducting four for the coke handling. The scurfing was not done by the employment of regular hands, because they did not have much to do. It was done by casual labour; but he had included the cost of the scurfing. It worked out to 4s. 0½d. per day. So the cost was included, although there was no man down for it. Leaving that out, their weight of coal handled per man was 4 tons 14⅓ cwt. As to the duration of labour, the author had made a great point of the fact that there was less labour for the men on the inclined system. He (Mr. Belton) had carefully timed their men at their work—not once, but many times. He might mention that the other day an engineer of a very small works came to see the Chester works; and he went into the retort-house with him. He had not seen the new plant before; and as it happened, they were drawing the bottoms of six beds of eights. Of course, they were drawing the bottoms on each side—24 retorts. The men started at three minutes past eleven—commencing punctually to that time. When his visitor and himself went into the house again, the men had three more retorts to draw. But on one side they had had a misbap with the charging-machine. The handle had broken; and they pulled it out and put in another. They repaired their machine, finished the charge, and they had done (tools down) by 25 minutes past eleven. This was practically

one minute per retort, including the drawing and charging, and with a breakdown into the bargain. The men cleaned up after the drawing and charging were finished. This generally took about a quarter of an hour; all the remainder of the time they had for refreshment and rest. What he meant to contend was that, with horizontal work on a good system, the men were a great deal less troubled than they were on the inclined system. He had been into inclined retort-houses where the retorts were not new, and had seen the attempts made to get the coke to come down. A few years ago, a paper was read—he thought it was in 1900, at the Institution meeting in London—by Mr. Charles Carpenter on his installation at Bankside. The paper was very severely criticized by an eminent engineer from the North, who told Mr. Carpenter that he was making a mistake in using machinery in a system in which machines were intended to be done away with. The next heard from the same eminent engineer on the subject of inclines was that, in the new works which he was then building, he was preparing for the mechanical removal of the charges from the retorts; and his next utterance on the subject, at the Glasgow conference, was to the effect that the coke from the inclines at the Granton works was to be removed by a hydraulic ram, which would extend 6 to 8 feet down the retorts. Where was the automatic result when they had to resort to a hydraulic machine to push the coke out? He had seen men working, not for one minute, but for over five minutes at a retort with long rakes before they could get the coke down. At the end of the paper Mr. Newbigging came to the *crux* of the whole position. He said there: "I am quite aware that these costs are less, both in the case of working inclined retorts and horizontal retorts with machinery, at many gas-works; but the conditions of labour and the rate of pay differ from those existing in Manchester." This had always been the difficulty gas engineers had to contend with. Comparisons were really worthless, unless the conditions were all brought into something like parallel lines. Here they had inclined retorts compared with horizontals worked under very bad conditions, evidently to the advantage of the inclined retorts. He (Mr. Belton) said the comparison was unfair; and if it went forth that inclined retorts were to be preferred because of the tabulated results given here, certainly the verdict would be a most unjust one. In the matter of the construction of his new house, he (Mr. Belton) would be glad if Mr. Newbigging would give them a little more information. He told them the house extended partly over the River Medlock; one of the side walls of the house being built on one of the river walls. "The river is 30 feet wide; and the covering consists of steel girders—the intermediate space between the girders being arched over with three rings of brickwork, the filling in of the haunches and the top of the arches consisting of concrete." He concluded that Mr. Newbigging had put the main flue of his settings on the ground floor; and he would be much obliged to him if he would tell them what was the construction below the main, as to what the ironwork and brickwork were protected by, the thickness of the material, &c. The paper was hardly one that he would have expected from an engineer of the position of Mr. Newbigging; and, in conclusion, he should like to put to him these questions: (1) What was the amount of gas produced per ton of coal by each system; (2) the amount produced per 20 feet of retort by each system; (3) the coke sold per ton of coal carbonized; (4) the coke used for fuel in his horizontals; (5) the quality of gas made (without enrichment); and (6) how the figure of 12 per cent. of fuel for the inclines was arrived at?

Mr. Robert Porter (Elland): Could Mr. Belton give us the cost of his gas into the holder under the conditions named?

Mr. Belton: That is a question you can work out for yourself. It depends very largely on the cost of purification and coal.

Mr. T. Duxbury (Oldham) said it was not his intention to say anything particularly about inclined retorts; and he did not wish to say much about them, because he was now looking out for the best installation he could get, either horizontals and stoking machinery or inclined retorts, or any other system. For some twelve months, he had delayed his extensions—rather considerable extensions—in order to get hold of the best plant in the market. He wished, therefore, to confine his remarks more especially to compressed-air stoking machinery, simply because—for the past eighteen months at any rate—he had had a fair amount of experience of this particular kind of stoking. It was rather singular, but Mr. Belton and himself on this point might almost have been comparing notes. At the same time, he (Mr. Duxbury) would like to have a few words, particularly on the first cost of horizontal retorts with compressed-air machinery and inclined retorts. Two years ago, he made a statement (he was prepared to admit) that, so far as he could see at that time, there was not much difference in cost between inclined and horizontal retorts. He was now speaking from experience. Two years ago he was speaking to a great extent theoretically, combined with a little experience. They erected at the Higginshaw works at Oldham a retort-house, containing nine through settings of eight horizontals, with compressed-air machinery. The total cost of the installation for all the work mentioned by Mr. Newbigging, leaving out the retort-house walls, but taking all the work inside the house (he had been very careful to get out the various items mentioned), worked out to £64 per mouthpiece—exactly the same figure as was given by Mr. Belton, although his (Mr. Duxbury's) was for compressed-air machinery and Mr. Belton's for manual machinery—the difference no doubt being due to the larger retort-house at Oldham reducing the cost for some portions per mouthpiece. However, it worked out exactly, taking every item, to £64 per mouthpiece. Mr. Newbigging gave £70 to £75 as being the cost of either inclines or horizontals. He (Mr. Duxbury) had taken out, on the same lines, the costs of inclined retorts, because he had been compelled to get out an estimate for his Hollinwood works. They had determined to advertise for both systems, inclined and horizontal—and for the De Brouwer or any other system in the market; and so he had had to go into the various details for three or four systems. He had compared horizontals and combined stoking machines with inclined retorts. He had got out a very careful estimate for Hollinwood on somewhat similar lines to the Higginshaw job; and the figures worked out for inclines for everything mentioned by Mr. Newbigging inside the retort-house, at £84 per mouthpiece. And he did not see how he could do it for less, if he was going to make a good job of it, for an inclined house. Then he found it would cost him £16 per mouthpiece for raising the roof, which he was bound to do if he was going to put in inclines; and this made the total £100. This was entirely a different experience from what he had two years ago; and therefore he wished to make it quite clear that the opinion he expressed then was not the opinion he held to-day. Yet, at the same time, he wished to-day to keep as free as possible from binding himself either to horizontals or inclines, because, when the tenders came in, they were going to adopt for Hollinwood the system that was going to be the best paying concern. One reason why he thought Mr. Newbigging confirmed his opinion about this extra cost for inclines was because he stated in the paper that renewing inclined retorts would cost about 74 per cent. more than horizontals for labour and material in the setting above the stage-floor. If labour and material cost 74 per cent. more for repairing, it followed that they would cost more in the first instance, or practically about the same amount. In his horizontal settings at Higginshaw, the brickwork cost £45 per mouthpiece for settings of eights. If they were going to add 74 per cent. on to this for inclines, it increased considerably the figure of £84 he had already given. But this point was not perhaps so important. Mr. Belton had touched upon one or two things that he (Mr. Duxbury) had intended to speak on, and he would pass them by. Coming, however, to what he considered the most important part of Mr. Newbigging's paper—the part relating to the cost of working a horizontal retort-house with compressed-air machines at the Bradford Road station at Manchester. These were single machines something like his own at Oldham; and he must say that he was surprised at a gas engineer coming forward and giving such figures as those as being the figures relating to compressed-air stoking machinery. Mr. Newbigging headed his paper "Horizontal *v.* Inclined Retort Installations, with Notes on Coke Conveying." If Mr. Newbigging had said "at Manchester," then he (Mr. Duxbury) could have understood it; but, unless the figures he gave were contradicted, it would go forth that the number of men mentioned was that with which they had to work installations of stoking machinery throughout the country. Now he knew of towns where they were doing the work at practically 100 per cent. less per ton of coal than Mr. Newbigging had given in the paper. He himself was doing it considerably cheaper. At their Higginshaw works they had only 44 men, while Mr. Newbigging gave 110. Although Manchester paid a little more than they did at Oldham per man, he had taken the same rate of pay for every man—he had based his calculation on the Manchester rate of wages; and he found that, if Oldham had to have 44 men for 219 tons of coal per day, then Manchester ought to have 76 men for 378 tons, and not 110. It seemed absurd for anyone to come forward and compare up-to-date inclined retorts with stoking machinery which was so badly handled as seemed to be the case at Bradford Road. If Mr. Newbigging had sent out his letter of inquiry to certain gas-works, he would never have published a statement of this kind—he would never have attempted to make a comparison between inclined retorts up-to-date and horizontal retorts with the number of men that was being employed in Manchester. He (Mr. Duxbury) had gone carefully into the estimate of the number of men he should require if he adopted the combined machines at Hollingwood; and these would need fewer men altogether than the single machines. He found, in the place of 44 men, he should only require 35 men to work the combined machines, as against 76 men which Mr. Newbigging gave in his paper for the same amount of work that he expected to do with the machines—double the number of men for the work that he (Mr. Duxbury) purposed doing at the Hollinwood station. In a case of this sort, he thought it unfair to blame the stoking machines. There was somebody else to blame; the stoking machines could not answer for themselves. There was somebody to blame for having this large number of men on the stoking machines; and it made it hard on gas engineers outside with their men pointing to Manchester having double the number of men for the same amount of work that they had to do. He had therefore taken the trouble to get information from several towns; and he found that there were quite a number who were doing the work cheaper than he was doing it. Oldham was a strong labour centre. He was also working six-hour charges. He did try five-hour charges; but his make per ton was not satisfactory. He found he got much better work for the six hours. He had compared these figures—the rate of pay and number of men required—on the same lines that Mr. Newbigging

had done; and he got a totally different summary. In the succeeding table, the author stated the cost of labour within the retort-house, exclusive of coke, at 1s. 6·47d. per ton of coal carbonized. The cost at the Higginshaw works was 1s. 1·06d. Then Mr. Newbigging put the cost of maintenance of the whole of the machinery at 2·5d. per ton of coal. He (Mr. Duxbury) agreed with Mr. Belton on this point. In his opinion, this was the most—well, he hardly knew what to say; it was a very high figure indeed. If he were to take the same figure for his work, he would have to put by £640 a year for repairing the machinery. They had only had the machines going eighteen months; and they had not cost them a £50 note. He did not see where the wear and tear for machines to the amount named by Mr. Newbigging was to come in, unless Manchester had taken this figure from one particular year which happened to be an exceptionally heavy one. He believed, as Mr. Newbigging stated himself, that this was only apparent; he did not think there was any reality in it at all, because he could not see how it was possible for stoking machinery to require anything like the amount of repair that Mr. Newbigging had given here. If the amount was divided by three, it would be considerably nearer the mark—if not over-estimated even at that. Coming now to the hot-coke conveyors, Mr. Newbigging mentioned the question of breeze. Here he strongly recommended something that he (Mr. Duxbury) had condemned after trying it. He recommended that, instead of a hot-coke conveyor, the coke should be removed by trucks with either a system of rope, locomotive, or horse traction. Formerly, in his own case, they had trucks which were pushed out by the men; but the work was so disagreeable and unhealthy, and steamy and sultry beneath the floor, that he could scarcely get men to do it. In addition to this, it was costing him double what it was costing him now with a hot-coke conveyor. Taking the coke out with the truck and man system, it cost them at the rate of £1896 a year. He had also tried the system adopted at Bradford Road, of trucks and horses, which, in his own case, worked out to a cost of £1712. But their present system of hot-coke conveyor was only costing them £953 a year. He was therefore saving getting on for £1000 a year by the adoption of the conveyor. He had allowed a full 15 per cent. for repairs and renewals. With the strong linked chain that he had, he felt convinced there would be nothing like that. He had had an offer to keep it in repair for 7 or 7½ per cent. a year, so he had allowed 15 per cent. and 6 per cent. for interest and sinking fund. Therefore he had allowed altogether over 20 per cent. These were figures that were actual. He now came to the point of breeze. He had been making some tests by collecting the coke at the outlet of the hot-coke conveyor and finding out the quantity of breeze made by the conveyor. Formerly the coke was dropped down into tippler trucks. They were pushed along, and turned over into a skip, and then a crane took it away. However, he had been catching the coke from the outlet of the hot-coke conveyor to the elevator; and he found the breeze they made was equal to 10 per cent. But that was when it was wet, being weighed immediately after it passed through a bath of water.

Mr. Newbigging: What is it throughout the year?

Mr. Duxbury said he had not had a year's working yet with the plant; but they had a coke crane carrying machine which had to drop the coke from a height of 30 feet. At present, they had no means of lowering the skip, so that what the breeze came out to on the year had nothing to do with the hot-coke conveyor. However, the tests made at the outlet of the conveyor gave him as the quantity of breeze 9·98 (or 10) per cent. weighed immediately after it had passed through a water-bath. He therefore thought the percentage of breeze mentioned by Mr. Newbigging was a long way outside the mark, if he (Mr. Duxbury) could only get 10 per cent. at the outlet of the conveyor. He contended that by the change he made by putting in a hot-coke conveyor, he was saving close upon £1000 a year. Then they had to take away from that such difference as there might be in the breeze.

Mr. Porter: £1000 on what quantity of coke?

Mr. Duxbury replied from 50,000 tons of coal a year. Coming to the end of the paper, he found that the cost of reconstructing the house referred to—including foundations, river covering, building, roof, retort-bench, ironwork, and chimneys complete—would be £122. Then the author stated that previous installations had cost £142 per mouthpiece. The cost of the building for the new house at Higginshaw was only £27 per mouthpiece; cost of the hot-coke conveyor, £8, and cost of coke storing, &c., £7—together £42 to be added to his (Mr. Duxbury's) £64, which made it into £110, against Mr. Newbigging's £122 or £142. Respecting the physical labour. He might say there was no physical labour with power stoking machinery. A man simply stood on the floor or stage, and worked a handle. The opening and the closing of the lids would have to be done with inclines as well as with machinery. He did not wish to express much opinion on inclines just at the present time, for the reason he had already explained. But for machinery, the figures given by Mr. Newbigging were, in his opinion, entirely unreliable—they ought never to have been compared with the system of inclines, and they ought never to have been published in a paper like this, as showing or suggesting that this was the result of the working of stoking machinery in other places outside Manchester. If Manchester had been stated in the title, it would have been different. The Bradford Road works were mentioned; but at the same time, reading the paper, anyone would almost think that these were the figures that stoking machinery could do, and that they would not do anything else but these figures. He did not think they got any benefit from a paper like this, because anyone who did not know what stoking machinery was capable of doing might be misled.

Mr. Isaac Carr (Widnes) said he thought they were getting a little bit wide of the mark. The figures that Mr. Newbigging had given were the figures of his experience; and it was clearly stated that they were the results of his experience at the works which were named in the paper, so that they were not going forth, as some people seemed to be under an apprehension they were doing, without some reminder that the experience was that at the works named in the paper. They were Mr. Newbigging's figures; and he (Mr. Carr) had no doubt he could defend them by all the necessary defence. With regard to the various systems of carbonizing coal, and making gas, it was of the highest possible interest to them all. He looked at these figures from time to time, and had noticed from year to year the progress that was being made with inclined retorts and stoking machinery. He really believed that, if this process continued, they would get to a state of things at which they could make gas at the price they could do it for under the old hand-fired system. (Laughter.) As to Mr. Kendrick's paper, he did not know whether they ought to call it a romantic paper or not, but it was very interesting in a way. Looking at his figures, they saw that he gave the cost of 16-candle coal gas as 11·8d. per 1000 cubic feet. That was the cost into the holder. Well, he (Mr. Carr) had frequently said in years gone by in discussing this subject, and he repeated it that day, that he was utterly unable to understand where, in that part of the country, the money went to, because the figures for maintenance that Mr. Kendrick had got in the paper as 5d. was about the figure of his (Mr. Carr's) total costs into the holder. He gained a little bit perhaps in residuals; he had a slight pull there. But in the matter of maintenance, he knew that Mr. Kendrick in his figure of 5d. was by no means alone among many friends of his (Mr. Carr's). They thought this was the necessary and proper figure to expend in the conduct of works. He could only say that, in his experience, he had never, or seldom, found it necessary to spend anything like the amount—one-fifth of it had been sufficient. There lay a great deal of the difference between his cost of working and that of many other works.

Further Discussion Postponed.

The President said they still had a certain amount of business to get through. He was afraid they would not be doing justice to the readers of the papers if they did not give sufficient time to the discussion; and therefore they would now postpone it to a future meeting. A great many members would, he knew, be pleased to take part in the discussion.

Votes of Thanks.

The President remarked that he had great pleasure in proposing a vote of thanks to their retiring President. He was sure they had all appreciated Mr. Ogden's conduct in the chair. He had had a most successful year.

Mr. W. W. Hutchinson (Barnsley) seconded the motion; remarking that Mr. Ogden had served the Institution exceedingly well, and had had a good year.

The motion was carried by acclamation.

Mr. Ogden thanked the members for the kind way in which they had accorded the vote of thanks. What he had done for the Institution had been with the hope of enhancing its value to the members and to the gas world generally. Whatever he had done, if it had gained the acceptance and favour of the members, he was amply repaid.

On the proposition of Mr. W. Whatmough (Heywood), seconded by Mr. A. E. Mottram (Ossett), the officers were one and all heartily thanked for their services.

Mr. Kendrick replied on his own and their behalf.

This ended the business proceedings; but before separating, the members had tea together.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

At the Monthly Meeting of the Association held on Saturday, in the Manchester School of Technology, Mr. F. S. Sinnatt, F.C.S., read a very interesting paper on "Flame."

The President (Mr. W. Hill) said Mr. Sinnatt had given a great deal of study to the special subject which would be dealt with in his paper, and it was to be regretted that, owing to the Institution holding their meeting that day in Manchester, many of the members of the Association had been unable to be present.

Mr. Sinnatt, in the course of some introductory remarks, said the subject of "flame" was one to which he thought gas engineers did not pay so much attention as they ought to do. The making of gas was only a means to an end; and he need scarcely remind the members of the well-known fact that a gas-pipe had two ends. Gas engineers looked after one end of the pipe, and did their work well; but who looked after the other? The case of that end—and it was the end which gave the light—was left in the hands of the public. To leave the public to do anything entirely

itself was criminal; and the gas engineers were to blame, when they did not supervise both ends of the pipe, for a great deal of the bad light of which they not infrequently heard complaints. All lighting of houses, &c., should be in the hands of the gas engineer, as were gas-stoves, &c.

Mr. Sinnatt then proceeded to give a technical lecture on the elements and chief characteristics of flame, illustrated by numerous practical demonstrations. At the outset he reminded his hearers that it was really only a comparative term to say that coal gas burnt in air, as air would burn quite as well in coal gas. With a coal gas atmosphere, they would have been called air makers, not coal gas makers; and in both cases they would have been flame producers. After briefly reviewing the history of the production of flame from the time of the discovery of coal gas up to the present, the lecturer dealt with the modern developments in the theory of flame. He reminded his audience that if a flame or if gas were mixed with air, the flame was non-luminous, very short, and hotter than a luminous flame. This was not altogether because the large quantity of oxygen burnt up all the carbon, because other purely inert gas would do exactly the same. The effect of carbon dioxide was very great—a small percentage in coal gas very considerably reducing the luminosity. This was the reason why it ought to be removed as far as possible. The action of nitrogen was to cool the flame, and thus prevent the decomposition which took place—no carbon being formed. Non-luminosity was also produced by cooling the flame (say) with a platinum disc; and by very rapid cooling any flame could be extinguished. The effect of heat on flame was to raise the luminosity. If the gas were heated first, the luminosity was greatly increased; and in similar manner the flame was affected by pressure. Referring to the development of incandescent lighting, the lecturer said the mixture now used in the Welsbach mantles consisted of 99·5 per cent. of thoria and 0·5 per cent. of ceria; the striking feature being that these proportions were absolutely constant if maximum candle power was required. A square inch of a mantle gave light equal to 34-candle power. If, however, pure thoria was used, the illuminating power was 3·8 candles per square inch. In conclusion, he said that, looking at the question of gas lighting from a purely theoretical point of view, what they wanted was: A perfect incandescent mantle—one which would last a year with ordinary usage, cost 6d., and possess a high lighting power; a practically non-luminous gas, say of 10-candle value at the most; a gas of high calorific power, to cost not more than 2s. per 1000 cubic feet; not more than 10 per cent. of carbon monoxide, and more special gas-fittings to be put in; and, lastly, everybody to be made by law to adopt incandescent burners if he wished to use gas.

A short discussion followed, in the course of which several technical questions were answered by Mr. Sinnatt.

Mr. Garlick said it would be a great advantage if they could manufacture gas of not more than 10-candle power, as by the reduction of the illuminating standard they would not only reduce the cost of making, but would get increased calorific power, which would be an advantage for the incandescent mantles, and also for gas cookers and heaters.

The President said the lecture had been a most interesting and valuable one; and they were much obliged to Mr. Sinnatt for the manner in which he had dealt with the subject he had brought forward.

Mr. Smith, in proposing a vote of thanks to the lecturer, remarked that unfortunately most of them had not the flame end of the gas-pipe under their control, as they ought to have; and the sooner they had it, the better it would be for all concerned.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Competition of Electricity with Gas.

A Meeting of the London and Southern District Junior Gas Association was held last Friday, at the Regent Street Polytechnic; the business consisting of an interesting paper by Mr. F. Ainsworth, of Ilford, on "Domestic and General Gas Supply," in which the author gave the results of his personal observations and experience in the matter.

After pointing out that the importance of this subject was most marked in the case of those who were in daily competition with electricity for lighting and motive power, the author took his own Company as an example of what some gas undertakings have to fight against. At Ilford, the electricity works are owned by the District Council; and the first thing they did was to take up all the street lighting wherever possible, regardless of expense. For nominal 25-candle power lamps (which did not average half this light), they made a charge of £4 5s. per annum. They had also the tram service, for which they supplied current at 2d. per unit; but for motors in competition with the Gas Company, the charge was 1¾d. per unit, and the motors were let out on hire. For lighting, the scale was 8d. and 2d., or a flat-rate of 5d. per unit, with free meters; while for the outside lighting of shops in competition with the Gas Company, they maintained, cleaned, and supplied current to arc lamps at the rate of 500 hours for £4 per annum, payable quarterly. As the voltage was 230, it would be readily seen that this was done at a cutting price. The Council also did wiring free and on the three and five years' purchase system; and they put in slot-meter installations which cost from £10 to £11 complete, and supplied current at 6d. per unit. Besides this, they canvassed the small houses where prepayment gas-meters were fixed, and put in electricity, though in some cases the occupiers stated plainly that they would only use the current when they thought fit.

Having thus given some idea of the sort of competition that might be expected from a corporation or district council, Mr. Ainsworth turned his attention to the best means to be adopted by gas undertakings for meeting it. After referring to the meter (which must be of sufficient capacity, if satisfaction is to be given), he touched upon the Welsbach, Keith, Sugg, Scott-Snell, Lucas, and other high-pressure and self-intensifying incandescent lighting systems; pointing out the necessity of using only the best burners and lamps. Another lamp which he believed would be the means of doing much for inside lighting was Podmore and Thomas's recuperative lamp. The results were not so good as with the systems just named; but the construction of the lamp, and the way the burners were fixed and protected from dust, would go a long way to make it popular for inside lighting. Another good point was that these lamps were supplied in clusters, and each burner could be used independently. Lamps of from 600 to 800 candle power might be very good for open spaces and large areas; but for general inside lighting it was necessary to have smaller burners in clusters. It was imperative for every gas company to undertake the maintenance of burners. This, and the fixing of mantles at reasonable prices, was doing much to educate the people in the proper use of the fittings. In connection with burners, there were one or two points which might be mentioned. It was quite easy to blow out the burner, fix a new mantle, and give a better light for a time; but what was wanted was a white-hot full incandescent mantle, and to secure this the supply must be right. The gauze should be changed fairly often; and it should be seen that the mesh of the gauze when fixed was perfectly even, and that the ring fitted under it to keep it in position was not turned in too much, which would interfere with the flow of gas. It was also necessary to clean round the steatite ring with a piece of fine emery paper. The noise sometimes heard in a "C" burner was often caused by the roughness in the gas-way of the plug of a bye-pass tap or the plug of the ordinary tap; and if this was taken off, the burner would be found to work all right. For general house lighting, he preferred "C" bye-pass burners with 8-inch chimneys, and in draughty and dusty places, No. 3 Kern burners. The "C" burners were rather quieter and more easily managed; and people were more accustomed to the use of this type.

Billiard-table lighting by incandescent gas had had to be undertaken to keep the electricians out; and for this purpose, the author said he used "C" bye-pass burners, with 8-inch mica chimneys and a clear crystal glass draught-screen, which, in case of accident, would catch the support, or anything that was likely to damage the cloth very much, and at the same time did not greatly impede the light. For shop lighting he recommended No. 4 Kern burners, as they were not so liable to get out of order, and the extra light they furnished outweighed the larger gas consumption. Where there was vibration, the mantle stood best on "C" burners; but where there was dust or draught, Kern burners were not affected so soon. Outside shop lighting was a source of anxiety and care; the difficulty being to get a lamp that would stand all weathers, and also give the best results in assisting the illuminating power of the burners. He had not found any lamp more suitable for this than the one made by the Crown Lamp Works; but he found the globes broke more often than he cared for. More than two years ago, they put down at Ilford a high-pressure installation worked by a gas-engine and a Keith compressor. They had a special main running from the show-room to 35 shops, which used 131 Keith burners. These were admired by all who saw them; and he had not heard one of the consumers say he would substitute electricity for them. Most of the lamps had three 10-feet Keith burners in them; and for these they made a charge of £5 a year, including cleaning and maintenance of the burners.

After giving particulars of some successful installations of incandescent gas lighting in local places of worship, Mr. Ainsworth referred to the question of mantles. He said mantles often got broken by the gas exploding when lighting; and to prevent this, the best thing was to place the fingers over the bunsen air-inlet. In dealing with mantles that had lost their illuminating power, they should ascertain the right size of flame for the particular burner used; and when this was once mastered, all it was necessary to do in case of doubt was to take off the mantle and see if the flame was all right. Cooking by gas was another important adjunct to the industry. The supply for this purpose should be run direct from the meter, and in no case should less than ½-inch pipe be used. With the different qualities of gas, and the varied percentage of water gas used, it was difficult for manufacturers to make cookers suitable for all circumstances; and therefore much was left for inspectors and fitters to do by way of adjustment. Heating stoves were another source of help in increasing the gas consumption, providing care was exercised in recommending the most suitable forms. They ought never to recommend a burner fitted in an ordinary grate and filled in with bricks and fuel, on account of the unsatisfactory amount of heat it gave

for the quantity of gas used. After procuring suitable fires, the next thing to do was to get them to burn quietly. The non-lighting-back burners had been strongly recommended; but his experience was that they clogged up with dust, &c., which made them burn sluggish, and that the adjustment was not so easy as with ordinary burners. Governors were very good in some cases; but on account of the expense and the variation of supply required, they often proved unsatisfactory. He had found a tap fixed at some distance away from the fire to regulate the gas do fairly well. The noise was certainly an objection which must be overcome. Richmonds had a very good arrangement for adjusting the air supply, which was handy for all who had a good percentage of water gas, and considerably obviated this trouble. Gas-engines were still another means of greatly assisting the consumption, and ought to be encouraged by supplying them as cheaply as possible, or on the hire-purchase system, and furnishing the gas at a reduced rate.

After giving a full explanation of the slot-meter system adopted at Ilford, Mr. Ainsworth concluded his very practical communication by a statement of what he considered gas companies should do to keep up their consumption, whether they had electricity in competition with them or not. In the first place, he thought each company should have its own fitters and show-rooms, and train up men to thoroughly understand the details of the business. If, he said, the three great London Gas Companies had been doing seven or eight years ago what they were doing to-day in the shape of looking after their consumers, the electricity companies would scarcely have survived—let alone flourished as they were doing. All companies should do what they could to advertise the best methods of using gas. Inspectors should visit other companies' districts and see what was being done, and discuss matters with each other; and the expense of this ought to be borne by the companies. Undertakings that were up-to-date in lighting, &c., would not have any need to fear electricity. There was a saying that if they took care of the pence the pounds would take care of themselves; and in the same way, if gas companies looked after the small things which worried the consumers, the greater things would look after themselves.

In the course of the discussion which followed the reading of the paper, Mr. Richmond said that the Ilford Council were doing with their electric light undertaking what other Councils were doing—that was, everything they could to secure custom. He had just fitted up three billiard-tables with inverted burners; and so far they were doing splendidly. Mr. Brown drew attention to the fact that with a coal-range there was always a supply of hot water available; while with a gas-cooker there was not. Mr. Dougall remarked that at Wandsworth some inverted burners were adapted to Wenham bodies; and they had answered perfectly, giving a splendid light and good ventilation.

Some interesting remarks were made by Mr. W. J. Liberty, who pointed out that there was no finality whatever in gas lighting. Everything was topsy-turvy now to what it used to be. In the old days, if anyone wanted a gas service, he had to go to the outer office of the inspector's department of the gas company, take off his hat, carefully wipe his shoes, and speak nicely to the inspector; and then, in course of time, he would get his request complied with, after signing a very strong agreement, and depositing some good sovereigns. All this had passed, however; and they were concerned now with the present and the future. There was no doubt that electric lighting was a very keen rival to the gas companies; they must admit this, and then make preparation to compete with it. For instance, taking the London area, it was totally different from others that might be represented there that night. They found that the three principal Gas Companies were constantly losing consumers by the hundred. That was to say, they were taking out meters sometimes running into four figures. It would be apparent to all that, in the case of a large improvement like the thoroughfare from the Strand to Holborn, when the County Council pulled the houses down the meters came out in very large numbers; and they were not replaced, because the space was filled up with very large buildings which were at once wired for electricity. How should they make up this leeway? Well, it was being made up. Taking the Gaslight and Coke Company, for example. In spite of the huge blocks of property pulled down for improvements and rebuilt, the Company had practically held their own, for the small decrease in the output for the past half year was hardly worth mentioning. Now, how had the loss been made good, for the gas had been manufactured and sold? It had been made up in several ways; and it was only by taking these means into consideration that the industry would be able to hold its own in the future. One of the principal methods was by fixing gas-engines for motive power. In the City and Strand and other crowded areas, there were thousands of manufacturers who had not room for steam power, but who had a basement in which a gas-engine could be put; and a great many of these places had been so fitted up. He found, however, that one Electric Light Company was advertising largely the fact that current was sold at about 2d. per unit, and little up-to-date motors were supplied, which could be fitted to printing or other machines. They all knew that these gas-engines represented a considerable amount of business. In a return he got up a short time ago for one of the Parliamentary Committees, he showed that in the London district served by the three large Gas Companies there were, at the beginning of 1897, no less than 4600 gas-engines of all sizes from ½-man power to 100-horse power. At that time there were in the South Metropolitan Company's district alone, 150 ½-horse power, 100 1-horse power, and 120 2-horse power engines at work. Since then the number of gas-engines in the Metropolis had grown considerably, and there were now about 8000, of which from 3500 to 4000 were in the district of the Gaslight and Coke Company, and 1500 or 1600 were in the little area called the City. The best customers of the Gas Companies were the printing, publishing, bookbinding, and allied trades. To give them an idea of the great extent to which this was going on, he might say that in 1898 there were 2971 gas-engines, representing somewhere about 44,000-horse power, made and sold in England and abroad by one English firm. If they wished to meet the competition of electricity, he recommended all those connected with gas companies to do the same as the electric light companies were doing—meet the consumers half-way, and give them a discount. The South Metropolitan Company had done it for years; and from the end of March, the Gaslight and Coke Company were going to allow from 2½ to 5 per cent. discount to all large users of gas for power purposes. The number of customers the Gaslight and Coke Company had lost in the central parts of London had been actually balanced by those they had gained by the prepayment meter system. To-day they had 157,000 of these slot meters in their district; while the South Metropolitan Company had no less than 155,000. If they could not get large consumers, they should secure small ones. He then referred to the displacement of electricity by gas at Victoria Station, which was noticed in last week's "JOURNAL." Mr. Richmond asked if it was found that electric motors were stepping into the field for the direct driving of small printing presses and like machines; and Mr. Liberty replied that the electric lighting companies had succeeded in getting them fixed up by hundreds—placed chiefly on light-running machinery.

The question of gas-fires was dealt with by Mr. H. A. Stephenson, who remarked that for daily use the old pattern of asbestos lumps in grates was deservedly gaining in popularity every day. For rooms used all day, gas-fires were too expensive; but for those required only at times, they should be indispensable. The maintenance system, he thought, could possibly be carried further, if the companies would take on the idea of looking after the consumers' fittings right up to the fires and ordinary flat-flame burners. But unless they were prepared to take up the maintenance of the whole of the fittings inside consumers' houses, they would not do much good in that line. At the meeting of the Midland Association the previous day, a paper was read which contained a suggestion that shilling-in-the-slot meters should be fixed in hotel bedrooms, for the supply of fire, light, and hot water. So far he did not think any hotels had taken up the idea; but possibly it could be carried out in the districts of some of the members. Mr. Dean said he favoured inverted burners for the lighting of billiard tables; and Mr. Farquhar thought gas undertakings had another enemy almost as bad as electricity—the cheap burner.

The President (Mr. Walter Grafton) said the remarks in the paper as to the noise made by the "C" burner were certainly interesting; but was it not due to something else than was mentioned by the author? Nothing was said as to the quality of the gas and the pressure employed. Then again there was no reference to the "York" burner. It was strange that this burner had not taken on much in London. In Liverpool, it was the burner of the place; they got better results with it there than with the "C" burner. Mr. Doman said that a good effect was secured by the use of inverted burners, three in a cluster, with no globe—simply an open shade.

Mr. Ainsworth replied at length to the large number of questions that were put to him in the course of the discussion. He said that the 10-feet Keith burners, at 8 inches pressure, equalled 300 candles. The charge made by his Company for the maintenance of incandescent burners was 7d. per quarter. The competition in Ilford was very keen, and perhaps they had had to do more than others; but when they got gas at 3s. 6d. per 1000 cubic feet and electricity at 5d. per unit with meters free, the Company had something to do—especially as the Council were at the back of the electric light undertaking. The charge made for maintenance was not sufficient, for it cost the Company at least 10d. a burner. Shops were visited fortnightly or every three weeks, houses monthly, and hotels weekly. As to lighting billiard-tables, he should not care to use inverted burners; for if any breakage occurred, the cloth would be spoilt. At Ilford, they had gone in for No. 4 Kern burners in the outside lamps. They answered better, and did not light-back. If the gas happened to vary, however, they were very sensitive. With regard to gas-fires in ordinary grates, these were things they wanted to stamp out. No matter what was done, they could not be made to give such a good heat as others; and he would not recommend those things that consumed a large quantity of gas, but the ones which used least. He had great faith in the future of the Kern radiator. In an hotel recently he had taken out 42 16-candle electric lamps and put in seven 2 burner Podmore lamps; and up to the present time the two burners had never been alight at once, as one was found to give sufficient light. He was so taken up with the lamp that in a shop 117 feet long, 36 feet wide, and 12 feet high, he was now putting 32 1-burner lamps; and he would be much disappointed if it was not one of the best-lighted shops in London or outside of it.

On the motion of the President, a very hearty vote of thanks was accorded to Mr. Ainsworth for his paper.

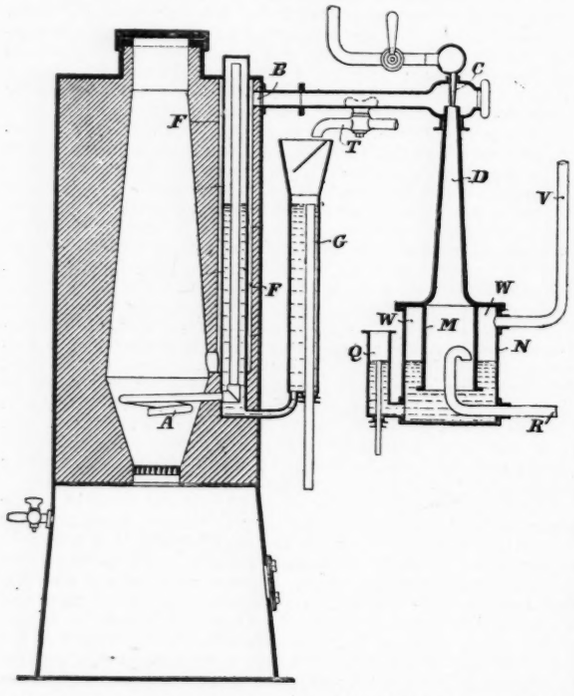
REGISTER OF PATENTS.

Water-Gas Apparatus.—Bauke, F., and Fuchs, C., of Berlin. No. 4019; Feb. 20, 1903.

This invention aims at providing a process by which "an always equal quality of water gas is ensured, by means of a continuously acting apparatus" specially adapted to be used for small industries.

In the lower part of the generator is a pipe A connected to a vertical pipe in a water-reservoir at the side. T is a dropping device arranged above a reservoir G connected to the generator reservoir and provided with a vertical overflow pipe. It is adjustable in height, so that the height of the water in the reservoir may be adjusted, and the generator reservoir can always be kept filled to a certain height.

C is a water-nozzle situated above the cone D, forming, in connection with the cone, a water-jet air-pump. This is connected by the pipe B to a space F around the generator reservoir, and, by means of an opening, to the interior of the generator itself. The cone is provided with a cylindrical prolongation M in a closed box N. The box is filled with water to a certain height, regulated by means of an adjustable overflow pipe situated in the pipe Q connected to the box N. R is a pipe, the end of which is in the prolongation M of the cone D, which pipe leads off the water gas as produced. V is a pipe connected to the space W above the water in the box N, to lead off the surplus of gas in case more is produced than is used.



The apparatus works as follows: The water in the generator reservoir is heated by the gases entering into the space F situated around the reservoir. The steam developed by the evaporation of the water in the reservoir flows downwards through the vertical pipe and the spiral-formed pipe A into the generator, and water gas is developed, which water gas escapes into the space F and serves again for heating the water in the reservoir. The water gas developed in the generator is sucked out through the space F by means of the water-jet air-pump C D, connected to the space F by the pipe B.

By means of this pump, not only the water gas is sucked out of the generator, but at the same time the steam developed in the reservoir is sucked out of the central pipe in which the steam is superheated. By adjusting the height of the water in the reservoir, the quantity of steam developed, and consequently the quantity and quality of water gas manufactured, can be regulated.

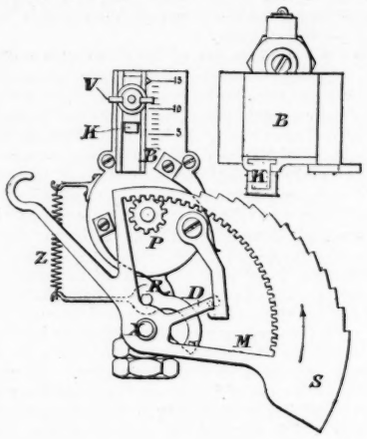
The jet-pump C D serves not only for sucking the water gas out of the apparatus, but also for keeping the water gas under a certain pressure. This is effected by the arrangement of the cylindrical part M, which forms, in connection with the box N, in a certain way a gas-holder, the pressure of which can be regulated by adjusting the position of the pipe in Q.

If irregularities in the use of the water gas occur, the gas will, by the pressure of the pump C D, be pressed through the water in the box N, and flow into the space W, whence it can escape, through the pipe V, into the atmosphere, or to any other place, at which it may be utilized.

Automatically Extinguishing Gas-Lights after they have Burnt a Given Length of Time.—Abel, C. D.; a communication from La Compagnie Anonyme Continentale pour la Fabrication des Compteurs de Gaz et Autres Appareils, of Paris. No. 6282; March 18, 1903.

This invention relates to apparatus capable of being applied in a great variety of ways and for various purposes. As an example, the patentees point to its application to the extinguishing of street-lamps where it is of importance from an economical point of view that the lamps shall be put out at the exact time ordered by the municipal authority.

The illustrations—an elevation of the apparatus and a plan—show that there is mounted on an axis X a quadrant lever S, having internal teeth gearing with a pinion P fixed on the axis of the spring of a clock-work, regulated so that the pinion is made to perform (for example) one or more complete revolutions during the maximum length of time the lights are to be kept burning. If the quadrant has the same number of teeth as the pinion, it will be seen that if the quadrant be turned by hand in the direction of the arrow by pulling at the hook, the gas-supply cock R will be opened and the pinion P, in revolving, will wind up the spring of the barrel corresponding to the extent to which S is turned. A pawl within the casing B, which contains the clockwork, causes the spring, in unwinding, to communicate its motion to a controlling device; and the spring, in unwinding, moves slowly backward (by means of the



pinion P) the quadrant S, which is made to complete the motion at the expiration of the predetermined time, as explained later. In turning the quadrant S by the hook, an arm M lifts a stud on a lever fixed to the plug of the cock, thereby turning the latter into the open position, until the stud engages with a pivoted spring catch N, and the lever and cock are thereby held in the open position until the catch is disengaged from the stud. When this takes place, the cock is rapidly closed by a spring Z connected to an arm on the cock plug, and tending to turn it in the contrary direction to the lever. The quadrant S has an arm which, when it is turned in the direction of the arrow, allows the catch N to engage with the stud of the cock lever as described; while when S has turned a certain distance in the contrary direction, the arm D presses the catch N out of engagement with the stud, and the cock is then rapidly closed by a spring as described.

The duration of the burning of the lamps will therefore depend upon the time occupied by the quadrant S and its arm M in turning back from the position into which it was raised into that in which the arm effects the release of the stud from the catch N.

The clockwork that controls the pinion P can be so regulated as (for example) to cause the pinion having 14 teeth to revolve twice in 16 hours, and to bring the quadrant having 28 teeth back from the point to which it had been turned in the opening movement into its starting position during the same time of 16 hours. The quadrant has on its outer periphery a series of stepped teeth or notches, which are at a gradually increasing distance from the axis X, as shown. It will be understood that if a stop were provided in such a position that one of the teeth would come in contact with it during the upward motion of S, the motion would be arrested at this point; and by rendering the stop adjustable, the opening motion of S could be limited to a fraction of its total motion. Thus the length of time between the lighting and extinguishing of the lights would be 16 hours. In the arrangement shown, the stop K for this purpose is mounted on a slide that can be moved up or down in a groove on the clockwork casing—being secured in position by a clamping screw, so that, according to the position into which the stop is moved, it will arrest the opening motion of S sooner or later, as described. At the side of the stop is provided a graduated scale, the divisions of which are marked with different hours of duration of the burning; so that the apparatus can readily be set to extinguish the light at any given time by setting the stop at the corresponding division of the scale. Having thus opened the gas-supply cock for the ignition of the lights, they must be extinguished at the exact time required. No personal attention is needed after having once turned the quadrant S for lighting; the clockwork being rewound every time the quadrant is so turned by the action of the pinion P, as described.

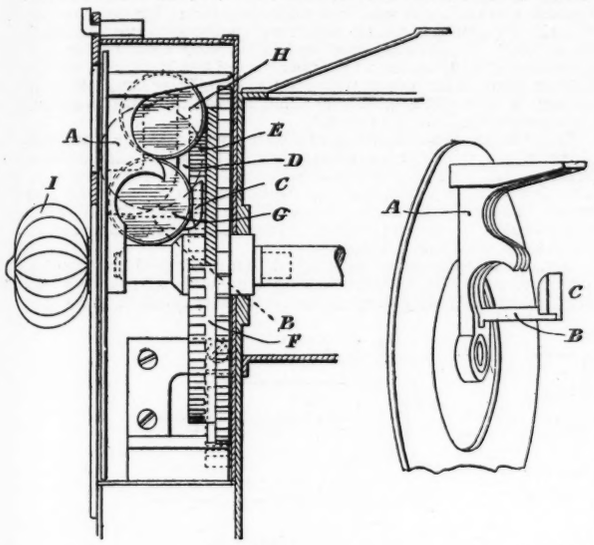
Coin-Freed Gas-Meters.—Glover, W. R., of Queen Victoria Street, E.C. No. 7167; March 27, 1903.

This invention relates to that class of coin-freed mechanism wherein the inserted coin acts as the means of connecting the operating handle to the mechanism; the object being to allow two coins to be inserted as well as a single coin—that is to say, that two half-pennies can be inserted instead of one penny, or two sixpences instead of one shilling. It is specially applicable to the meter described in patent No. 25,272 of 1894.

A sectional side elevation of the arrangement is given, showing the coins in position; also a perspective elevation of the coin-pocket.

The coin-pocket A is made of greater depth than usual, and of skeleton formation; the lower part being provided with a bar B having a lug C standing upward. When a penny D is employed, it rests in the coin-pocket and between the top of the lug and the wall or other part

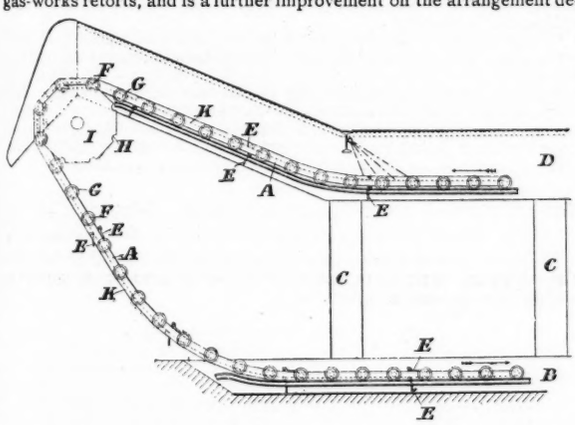
of the meter—one edge being between the teeth E of the operating wheel F, to form a means of connection between the operating handle and the mechanism, as in dotted lines. But when a penny is not obtainable, and two half-pennies are required to do the work, the first inserted half-penny G rests in the coin-pocket and between the lug and

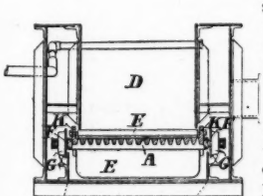


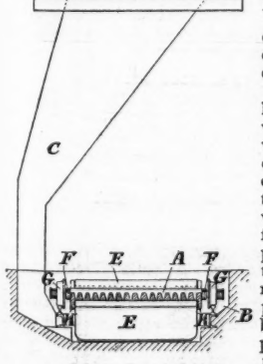
the wall, but lower down in the coin-pocket, and the next inserted half-penny H will rest upon the first inserted coin G, and find a lodgment in the teeth E of the operating wheel F and in the coin-pocket; so that, on the turning of the handle I, the mechanism can be actuated. If, however, a farthing or smaller coin than that which the apparatus is intended to take is inserted, it will fall through the skeleton coin-pocket to the till.

Hot-Coke Conveyors.—Graham, M., of Hunslet, Leeds. No. 6524; March 20, 1903.

This invention relates to apparatus to convey hot coke direct from gas-works retorts, and is a further improvement on the arrangement described in patents Nos. 24,659 of 1899, 11,979 of 1900, 1560 of 1903, and 4237 of 1903. The main object is to provide, in these and other types of conveyor, means whereby the conveyor-trough may be kept clear of any water and sediment from the quenching and subsequent draining of the coke during transit. The method of driving the conveyor within the trough is also improved.







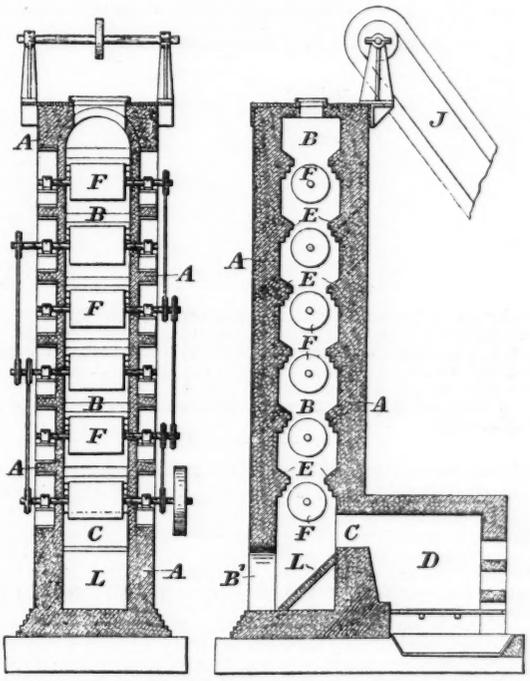
A front elevation of part of a coke-conveying plant is given; also an end elevation (in section) on a somewhat enlarged scale.

The lower or return part of the endless travelling conveyor A is enclosed within a trough B, connected at convenient intervals by pipes, channels, or passages C, with the trough D enclosing the upper or forward part of the conveyor. The conveyor is provided, both on its outer and inner surfaces, with a series of hinged push-plates E; those on the lower side of the conveyor (both forward and return) remaining suspended in a vertical position, and prevented from turning back upon their hinges by means of projecting shoulders or stops; while the push-plates on the upper side close up and lie flat against the surface of the conveyor. The whole of the water and sediment accumulated in the upper trough D is therefore pushed along by the action of the plates E, and is discharged, through the connecting pipes or channels C, into the lower trough B, from which it is discharged into a sump or collecting tank at the extreme end of the trough B by the action of the push-plates E on the return part of the conveyor.

To facilitate the driving of the endless conveyor, collars F are provided at each joint—preferably at each end of the hinge pin and within the supporting runners or wheels G—adapted to fit within corresponding recesses H in the periphery of the sprocket wheels I at each end of the apparatus. Each section or link of the endless conveyor, whether perforated or otherwise, is provided with raised flanges K along the sides, for the purpose of preventing the coke falling on to the wheels or runners G and the collars F.

Utilizing Spent Lime and Clinker for Brick Making, &c.—Lowden, J., of Leeds. No. 7622; April 2, 1903.

This invention relates to apparatus for treating spent refuse lime from gas-purifiers in combination with clinker, so as to form bricks, slabs, or other similar moulded objects. The treatment consists in exposing the spent lime, or spent lime mixed with clinker, to the hot gases of a regenerative or other furnace, and an excess of heated air. The heated air expels a large proportion of the sulphur compounds from the lime, and, by the oxidation of the sulphur compounds of calcium, produces calcium sulphate. When the spent lime to be treated is free from sulphur compounds, an admixture of clinker, previous to treatment, results in silicate of calcium being produced.



The illustration shows two sectional elevations of one form of a tower used for carrying out the invention, taken at right angles to each other.

The spent lime (or lime and clinker) is treated in the tower A, having a passage or shaft B, extending from top to bottom. The shaft communicates, by a passage C, with a furnace D, at the base of the tower. The shaft also communicates with the outer air, as shown at B^1. The gaseous products of combustion, from the furnace at the base of the tower, pass upwards through the shaft, and at the same time the air which is drawn into the shaft through the passage B^1 passes up the tower in combination with the gases, and is therefore heated. On opposite sides of the tower are formed a number of projections E, acting as bafflers—both to the material to be treated and the heated air and gaseous products; and at the same time forming between each pair of projections what might be termed a chamber. Mounted in each of these chambers is a drum or cylinder F driven by suitable mechanism. The said cylinders are constructed with longitudinal openings G in their circumference, and contain perforated partitions H, dividing the interior of the cylinder into a number of compartments.

The material to be treated is carried by an elevator J to the top of the tower, and falls into the top of the shaft B and on to the first cylinder F through the longitudinal openings into the compartments formed in the cylinders. As these revolve, the heated air and gaseous products pass upwards, and the material is thoroughly impregnated with the heated air and the gaseous products of combustion. The spent lime falls from the first cylinder on to the projection E, at the bottom of what might be termed the first chamber, and thence passes through the second cylinder on to the projections E in the second chamber, and so on until it reaches the bottom of the passage B, which is made inclined, as shown at L, in order to let the treated mixture slide into the outer air.

The resultant of the above treatment is then mixed with a portion of clinker and a quantity of coke breeze, or other like fuel. The mixture is then thoroughly burnt in a kiln or furnace. The passing of steam through the mixture while it is being burnt considerably improves it.

The mixture now consists of calcium oxide and the silicate of calcium and alumina and calcium carbonate, and may be ground and used for making bricks, slabs, and other like objects. After having been ground, the mixture is made up into bricks or the like in the ordinary manner, with this exception, that, when so made, they do not require "burning." The further hardening of the bricks is facilitated by exposure to the hot waste gases containing carbon dioxide.

Retort-Charging Scoops.—West, J., of Manchester, and Carpenter, W. J., of Great Yarmouth. No. 10 326; May 6, 1903.

This invention relates to the construction of hand or machine worked scoops for charging gas-retorts.

Hitherto, scoops for this purpose have been generally made (the patentees point out) of a semi circular or V shape, and have also been made with a plain vertical division plate or mid-feather along the whole length of the scoop, and added to it, for the purpose of assisting in the even distribution of the coal in the retort. Previous to the present invention, the operation of charging a retort with coal by a scoop having a plain central mid-vertical feather has been to fill the scoop, drive it into the retort, and deposit its contents by reversing the scoop towards one side of the retort. The scoop is then withdrawn, refilled, and again driven into the retort; this time reversing the scoop towards the opposite direction, so that the coal is deposited towards the other side of the retort. In this arrangement, although the mid-feather assists in throwing the coal towards the sides of the retorts, it is found in practice, and especially with wide retorts, that the coal is thicker in the centre of the heap, and there is a zone in the centre which is insufficiently carbonized by the heat of the retorts. Their invention therefore relates to an improved mid feather or division plate for the scoop, "having for its object a more perfectly even distribution of the coal in the retort." Instead of the feather being a plain division plate, it is constructed to a Y section; the upper part of the Y division plate or feather when the scoop is reversed "effectually accomplishing the proper delivery and spreading of the coal, which is laid in an even thickness on the floor of a retort."

Fig. 1 shows the application of the improved scoop to a machine-driven charger. Fig. 2 is a section showing the scoop filled with coal and entering the retort during the first portion of the operation of charging it. Fig. 3 shows the coal deposited towards one side of the retort. Fig. 4 shows the coal deposited towards the other side of the retort—the scoop having been withdrawn and re-filled after the first half of the retort has been charged.

Fig. 1 shows the scoop A, attached to a carriage B, supported by the framework of a machine holding the supply of coal and other mechanism for moving the machine from retort to retort, and driving

Fig. 1.

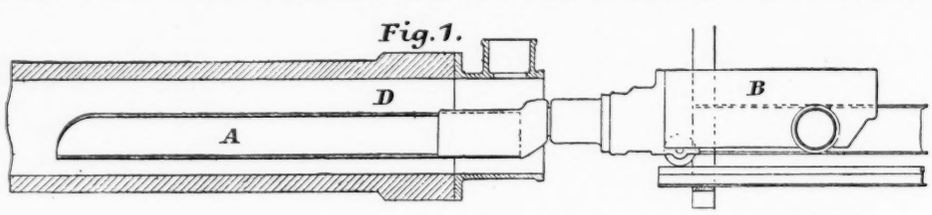


Fig. 2.

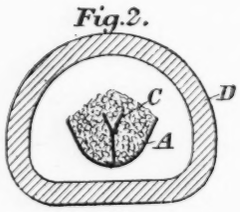


Fig. 3.

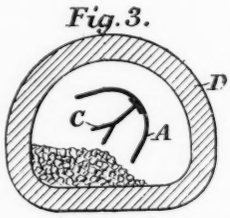
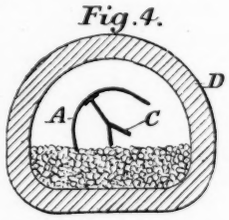


Fig. 4.



the charger and scoop in and out of the retort, and also the scoop-reversing gear for emptying the scoops to either side of the retort. In fig. 2, C is the division plate or mid-feather of Y section; the scoop being shown entering the retort D with a charge of coal. In fig. 3, the scoop is shown reversed, and the coal emptied towards one side of the retort; while in fig. 4 the scoop is shown reversed and emptied towards the other side.

Combined Water-Gas and Coal-Gas Producer.—Boult, A. J.; a communication from J. E. Goldschmid, of Frankfurt-on-the-Main. No. 7770; April 3, 1903.

This invention relates to the manufacture of a mixed gas obtained from water gas and lighting gas; "the whole mass of coal which had been previously treated in lighting-gas retorts and then in water-gas generators being gasified." The patentee points out that the "attempts made hitherto of converting coal directly into water gas and of utilizing the products of distillation obtained in the gas generator presented many difficulties; although in many cases the process is successful, there are many kinds of coal altogether unsuited to it."

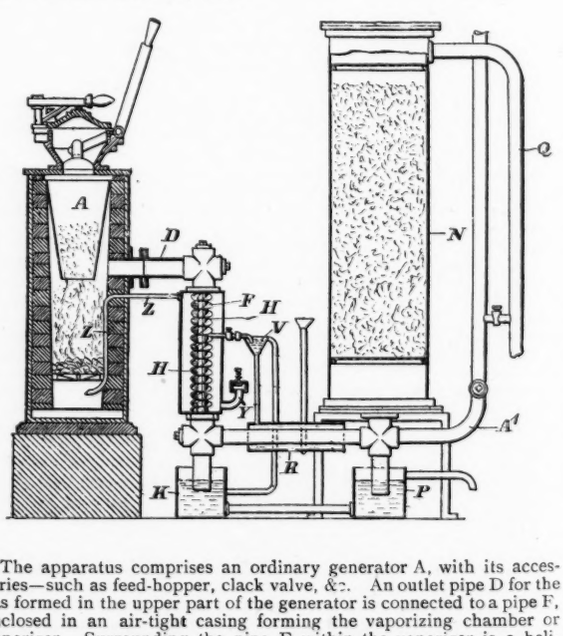
In his specification, the patentee says: The invention chiefly consists in coking the coal in the lighting-gas retorts, converting the coke into water gas, and passing the same through the lighting-gas retorts. The object of coking in this case is not to obtain as large a quantity of gas as possible by distillation, but to remove from the coal such a quantity of gas as would have caused the caking of the coal when introduced into the water-gas generator. Therefore, the best way of carrying out the invention is as follows: As is well known, during the first period a much larger quantity of gas is developed in the lighting-gas retort than in the later period of the operation; the cost of fuel used for heating the retort remaining the same. By doing away with the second gasification period in the retort, and by effecting instead of it gasification in the water-gas generator, a great advantage is gained. When the water-gas generator is blown from the top downwards, all the gas still contained in the coal after the partial coking is utilized. For the rest, the various well-known methods which have been adopted for obtaining water gas direct from coal may be, of course, employed—for instance, double generators may be used, &c. This process is of extreme importance in cases in which the water gas obtained is introduced into lighting-gas retorts and utilized therefor—quickly and thoroughly expelling the hydrocarbons, without the formation of any residues.

The patentee does not illustrate any special form of plant for the carrying out of his process, which he describes as follows: The coal is first heated in gas-retorts in the usual manner; the period during which it is heated being about half the usual time, more or less, according to the kind of coal used, but in any case considerably less than would be necessary for complete gasification. During the whole of this time, a strong current of water gas is allowed to pass through the retorts. The semi coke obtained in this manner is thereupon placed in a water-gas generator. In the latter, the usual water-gas process may be carried out—that is to say, blowing from the bottom for the production of carbonic acid. Parts of the hydrocarbons still present escape sometimes, or partly, into the atmosphere, or the blowing can be effected from the top, or fresh coke may be placed on freshly-blown layers and then gas blown in; and in this way the whole quantity of hydrocarbon still present is obtained.

The invention consists further in "the special way of making a diluted water gas. Carbonic acid obtained by the Dellwik process during the blowing period is especially suitable for this purpose. This acid still contains some carbon oxide, which in this way is also utilized. Besides, the partial coking of the coal in these cases can be very small, as it is possible to allow the products of distillation of the freshly-charged coal to escape during the blowing process with the carbonic acid, and then to bring them again to the gas together with the said acid."

Gas-Generator.—Kiderlen, A. E., of Amsterdam. No. 23,751; Nov. 2, 1903. Date claimed under International Convention, Jan. 3, 1903.

This generator acts by suction, and comprises an automatic feed for the vaporizer, regulated according to the work done by the motor to which the generator is applied.



The apparatus comprises an ordinary generator A, with its accessories—such as feed-hopper, clack valve, &c. An outlet pipe D for the gas formed in the upper part of the generator is connected to a pipe F, enclosed in an air-tight casing forming the vaporizing chamber or vaporizer. Surrounding the pipe F within the vaporizer is a helicoidal wing H, which extends from the top to the bottom of the pipe. The pipe F is connected below the vaporizer to a union, and continued

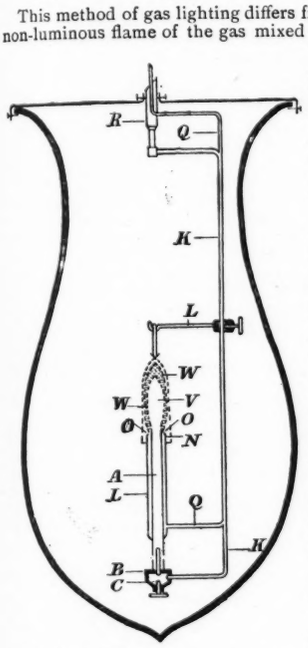
in a straight line by a nozzle, which dips into a water-reservoir K. It is also connected by the union to a horizontal pipe, which conducts the gas to another union placed beneath the bottom of an ordinary coke column N. Upon the same union a nozzle which dips into a water-reservoir P is branched. The two nozzles are intended to free the gas from dust and other impurities which it may carry in. Q is the pipe for leading the purified gas to the motor to be served.

The pipe between the nozzles passes into a horizontal jacket R, into which water is poured through a funnel, and which water, after having abstracted from the gas a great portion of its heat, moves up in a state of ebullition into a vessel V, furnished with an overflow in such a manner that the water is kept at a constant level—the overflow water running off into the reservoir K.

At each suction of the motor, water from the vessel V is sucked up and spread over the helicoidal wing H, and descends the length thereof. The water is heated by the gases sucked in from the generator through the pipe F, and encounters a current of air, sucked in at the same moment through the pipe Y (saturated with moisture), through the pipe Z. In passing through the pipe at the inside of the generator, the mixture is superheated, and is finally discharged beneath the furnace in contact with the incandescent coke. The water will only be admitted to the vaporizer at each suction of the motor—that is to say, the admission of water to the generator will be proportional to the work done by the motor.

Incandescent Burner with Oxygen Supply.—Tresenreuter, G., of Berlin. No. 24,745; Nov. 13, 1903.

This method of gas lighting differs from other processes in that the non-luminous flame of the gas mixed with air before ignition is surrounded on its outer surface by a current of oxygen, which escapes from the supply pipe at the same pressure as the normal pressure of the lighting gas in such way that the current of oxygen enters the incandescent mantle and comes in contact with the inner wall of it.



In preparing the mixture of air and gas, care must be taken (the patentee points out) to supply less air than is required by the gas for complete combustion; so that the non-luminous flame shall contain a certain amount of unburnt gas, which is burnt in the stream of oxygen. In this way, two quite distinct processes take place. First of all, the chief gas mixture which carries the required air for combustion forms a non-luminous flame of normal intensity, and then the small excess of gas forms, with the oxygen current, "a flame of extraordinary intensity." As the flame is formed in close proximity to the mantle, the latter is heated to "an extraordinarily strong degree, and gives a light of unusually great power."

This high lighting power is obtained with but a small consumption of gas and oxygen, by reason of the high intensity to which the mantle is heated, whereby it becomes possible greatly to reduce its surface. The cubical contents of the mantle may be very small, and the flame surrounded by it will be correspondingly small, as also the quantity of oxygen required.

The lighting body gives, it is said, 250 to 300 normal candle power; and the mantle has an effective height of 22 mm. The largest diameter at the bottom is 11 mm., and the largest diameter at the top 7 mm. The lighting gas-supply pipe has an inside diameter of 1·5 mm.; the oxygen-supply pipe an inside diameter of 1 mm. The consumption of lighting gas for obtaining the 250 to 300 normal lighting power amounts to about 20 litres per hour, and the consumption of oxygen to about 18 litres per hour.

As shown, the burner-tube A is secured with its bottom end on the cover B of a gas-chamber C, and is provided at the bottom (around its circumference) with air inlet holes so as to form a bunsen tube. A gas-nozzle is concentrically arranged in the lower part of the pipe A, and enters the gas-chamber. Between the inner wall of the pipe A and the nozzle is an annular space or chamber, which forms a passage for the air entering the burner pipe, in which takes place the mixing of air and gas. The lower end of the nozzle in the gas-chamber acts as a valve seat for a conical screw valve mounted in the bottom of the gas-chamber, so that the gas supply to the nozzle can be regulated. The pipe K supplies the gas-chamber C with lighting gas at the ordinary pressure. Above the air inlets is arranged, concentrically around the burner-tube, a tube L of larger diameter, the lower end of which fits tightly round the bunsen pipe, while the upper end is slightly drawn in towards it, without, however, touching it—on the contrary, forming with it an annular slot O. The outer tube L is so mounted on the bunsen pipe that the latter projects beyond the former to a small extent. The annular space between the two tubes A and L forms a chamber to which oxygen is supplied, through a pipe Q, at the pressure usually obtained in the gas-pipes. The oxygen-supply pipe is arranged next to the gas-pipe, which merges at R into the main gas-pipe; while the oxygen-pipe passes either through the main gas pipe, as shown, or in some other way, to the oxygen-reservoir. On one or both pipes K and Q slides an adjustable screw clamp for supporting the incandescent mantle-holder.

The lighting gas enters the gas-chamber C through the pipe K, and escapes through the nozzle into the burner-tube A. The gas issuing through the nozzle draws air into the burner-tube through the air-inlet holes, and the air and gas mixture thus formed gives, inside the mantle, the non-luminous flame V. The oxygen gas as supplied escapes through the annular slot O into the interior of the mantle; and the annular slot, as well as the projecting burner pipe end, cause the current of oxygen to assume almost a cylindrical form. Rising in the mantle, this current of oxygen comes in contact, on the one hand, with the inner surface of the mantle, and, on the other hand, with the outer part of the flame V; and thus forms, by the combustion of the unburnt gas particles in that place, the oxygen intensified flame W, which assists the intense heating of the mantle.

APPLICATIONS FOR LETTERS PATENT.

3131.—Gardner, F. A., "Gas-engines." Feb. 8.
3137.—Roberts, D., and James, C., "Gas-engines." Feb. 8.
3148.—Laidlaw, W. K., "Prepayment meters.' Feb. 9.
3169.—Cash, F. T., "Gas-chandeliers." Feb. 9.
3177.—Tourtel, J. M., "Coin-freed meters." Feb. 9.
3209.—Riminton, M. L. J., "Gas cooking-stoves." Feb. 9.
3266.—Hinchliffe, J. A., "Gas-controller." Feb. 10.
3291.—Bowe, W., "Gas-power plant." Feb. 10.
3315.—Pissarreck, O., and Schmidinger, J., "Manufacture of gas oils." Feb. 10.
3321.—Graham, M., "Charging retorts." Feb. 10.
3340.—Rostin, H., "Gas-lighting apparatus." Feb. 10.
3351.—Klinger, R., "Connecting gas-pipes." Feb. 10.
3392.—Brierley, R., "Mixing acetylene gas with other gases for lighting and other purposes. Feb. 11.
3436.—Pilgrim, R., "Acetylene generators." Feb. 11.
3482.—Haddan, H. J., "Acetylene lighting." A communication from E. L. Frenot. Feb. 11.
3570.—Holbrook, W. E., and Bibbero, M., "Incandescent burners." Feb. 12.
3598.—Arundel, H. B., and Higginson, J., Jun., "Providing a uniform mixture of gas and air to burners." Feb. 12.
3602.—Radermacher, P., "Gas-light controllers." Feb. 12.
3606.—Zechnall, L., "Lanterns for inverted burners." Feb. 12.
3632.—Pratt, W., "Inverted incandescent burners." Feb. 13.
3721.—Clapham, S. B., "Condensers." Feb. 15.
3726.—Jackson, W. H., "Inverted incandescent burners." Feb. 15.
3748.—Potter, W. G., "Inverted incandescent burners and lamps for railway carriage lighting." Feb. 15.
3800.—Tresenreuter, G., "Air and gas carburettors." Feb. 15.
3821.—Mackenzie, G. P. & R. K., "Mantle." Feb. 16.
3851.—Brough, W., "Mantle holder." Feb. 16.
3858.—Keith, J. & G., "Gas-irons." Feb. 16.
3921.—Stickdorn, R., "Incandescent burners." Feb. 16.
3938.—Hills, H. G., "Manufacturing gas." Feb. 17.
3979.—Rutherford, C., "Clock for regulating gas-light." Feb. 17.
4049.—Sutcliffe, H., "Incandescent burners." Feb. 18.
4074.—Henry, F. L. M., and Patiny, L. L. E., "Acetylene gas." Feb. 18.
4082.—Edgar, W., "Burner bye pass and ignition-tubes. Feb. 18.
4099.—Bumford, E., "Gas-furnaces." Feb. 18.
4137.—Lindemann, O., "Internal combustion engines." A communication from Körting Bros. Feb. 18.
4139.—Stanton, C. W., "Retorts." Feb. 18,
4180.—Duncan, W., "Stopcock with bye-pass." Feb. 19
4209.—Holbrook, W. E., and Bilbero, M., "Suspending gas-fittings." Feb. 19.
4214.—Elliott, R. P., and Billmeyer, F. P., "Incandescent burners." Feb. 19.
4261.—Wallace, C. W., "Generation of acetylene." Feb. 20.
4267.—Stevens, J. H., and Jones, H. A., "Incandescent lamps." Feb. 20.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read a second time: Gosport Water Bill, Newcastle and Gateshead Water Bill, New River Company Bill, and Ticehurst and District Water and Gas Bill.

The Barnard Castle Gas Bill, the Matlock and District Gas Bill, and the Withnell Gas Bill, have been referred to a Select Committee, consisting of the Duke of Bedford (Chairman), Earl Carnwath, Earl Fitzwilliam, the Earl of Harrowby, and Viscount Colville of Culross; to meet on Tuesday, March 8.

HOUSE OF COMMONS.

Tuesday, Feb. 23.

RICKMANSWORTH AND UXBRIDGE VALLEY WATER BILL.

On the order for the second reading of this Bill,

Mr. Disraeli moved the rejection of the measure, which he said was identical in character with the one rejected in 1901. The Bill was opposed by nearly every Local Authority affected by it, especially by the Bucks County Council, on the ground that no water company should be allowed to take water out of the county unless they were prepared to replace it; and this undertaking had not been given to the Council. The soil of the county was dry, and it would cause a great deal of

damage to the agricultural districts if water were taken away and no recompense provided.

Mr. ROTHSCHILD, in seconding the motion, supported the protest that had been made by the Bucks County Council. He said the underground wells and lakes near the Chiltern Hills would suffer great injury if authority were given for them to be depleted of their stores of water in the manner proposed.

Colonel LOCKWOOD hoped the usual course would be adopted of reading the Bill a second time and sending it to a Committee, which was the proper tribunal to decide the points at issue between the two opposite interests.

Mr. LAWSON WALTON contended that local opinion as to local needs ought to have a deciding influence in a matter of this kind; and the Bill was opposed by all the Local Authorities concerned.

Sir F. BANBURY supported the second reading. He thought the House ought not to reject a Private Bill at this stage, unless there were strong objections to it; and he failed to see any in the present case.

Mr. BUXTON pointed out that, though the Bill introduced two or three years ago was rejected without a division, the Company now came again to Parliament with their old weak case, but with a more extended scheme.

Sir J. DIMSDALE said the Bill was brought forward merely to remedy an error in a previous Bill; and the Company asked for no further powers than they at present possessed.

Mr. J. W. LOWTHER said it was very undesirable that these matters, which were purely local, should be discussed in the House. They ought to be referred, almost without question, to a Committee, unless they involved some question of a new principle, which this Bill did not. There seemed to be a quarrel between two Water Companies as to who should possess a certain district; and the County Council favoured one Company.

Sir W. FOSTER said an invasion was proposed of the rights of Buckinghamshire over its own area, and it was the privilege of the House to discuss such a question.

After some further discussion, the House divided, with the following result: For the second reading, 24; against it, 150—majority, 126.

The following further progress has been made with Bills:—

Bills read a second time and committed: Brixham Gas Bill, North-Western Electricity and Power Gas Bill, Rotherham Corporation Bill, Ryde Gas Bill, and Southend-on-Sea Gas Bill.

Bills reported: Blyth and Cowpen Gas Bill, Hampton-in-Arden Gas Bill, Southend Water Bill, and Whitby Gas Bill.

The Arsley Gas Bill, the Brymbo Water Bill, the Chippenham Gas Bill, the Kirby-in-Ashfield Urban District Gas Bill, the Littleston-on-Sea and District Water Bill, and the South Shields Gas Bill, have been referred to a Select Committee, consisting of Mr. Fison (Chairman), Mr. Soames, Mr. Reginald Lucas, and Mr. Runciman, who will hold their first sitting to-day.

LEGAL INTELLIGENCE.

The Marylebone Electric Lighting Question.

The difficulty which has arisen out of the statutory power granted to the Marylebone Borough Council to purchase the portion of the undertaking of the Metropolitan Electric Supply Company, Limited, which is within the borough for £1,212,000 reached a further stage on Friday, when application was made to Mr. Justice Buckley, on behalf of the Council, for an extension of time in which to complete the purchase. It was stated that the Bill which had been promoted had passed the second reading; but the Company wished that the Council should provide £27,500 for capital expenditure in respect of the undertaking as a term upon which the extension till Aug. 31 should be granted. The Council urged that they would have great difficulty in raising the money; but, on the other hand, the Company contended that it was not fair that they should be called upon to provide capital for an undertaking which the defendants had contracted to buy. His Lordship extended the time for the completion of the purchase till April 30, on condition that the Council found £15,000 to meet the capital expenditure.

Unfounded Charge of Unlawfully Using Gas.

At the County of London Sessions, on Thursday, before Mr. Loveland Loveland, K.C., Deputy-Chairman, William and Henry Read, brothers, surrendered to their bail, to answer an indictment for stealing gas from the Gaslight and Coke Company. The accused and three other brothers carried on business, on behalf of their mother, as jobbing builders, at a workshop and storeroom in Adelphi Arches. On the 4th of January, a gas-fitter named Williams, in the service of the Company, went to the defendants' workshop to examine into a fault in the supply of gas to the cellars of a firm of wine merchants, which were underneath; and he alleged that he found that the gas-meter in the workshop had been cut off from the main, and the latter connected with the pipe leading to the fittings, so that gas was being used without passing through the meter. He called in a fellow-workman, who gave similar evidence, but they said nothing about it at the time. They reported the matter, however, at the head office the same day, and in the evening two inspectors were sent, who found that the temporary connection was no longer there, and the gas was passing through the meter in the proper way. It was alleged that the joints of the pipes then bore marks of the recent use of tools upon them; but witnesses were called for the defence, who examined the meter shortly afterwards, and denied that any such marks existed. The defendants also went into the witness-box, and swore that no temporary connection had ever been used. They were acquitted. Mr. Loveland Loveland said he quite agreed with the verdict; but, in justice to the Company, he thought he ought to say that this was a proper case for investigation.

MISCELLANEOUS NEWS.

NANTWICH GAS ARBITRATION.

Monday, Feb. 22.

(*Before Sir* G. BRUCE, M.Inst.C.E., *Umpire.*)

The arbitration to determine the price to be paid by the Nantwich Urban District Council for the purchase of the undertaking of the Nantwich Gas Company was opened to-day at the Surveyor's Institution. Mr. E. H. STEVENSON was Referee for the Council; Mr. CORBET WOODALL for the Company. Mr. BALFOUR BROWNE, K.C., appeared on behalf of the Council; and Mr. HONORATUS LLOYD, K.C., and Mr. VESEY KNOX represented the Company.

Mr. HONORATUS LLOYD, in opening, said the purchase took place under an Act obtained last year by the Council. The Company was formed in 1869 under the Companies Clauses Act, with a capital of £6000. The capital was now £12,000 ordinary stock, £5000 preference stock, and £7000 of debentures. For a period of over twenty years after incorporation, the Company went on supplying the district without anyone casting envious eyes on the undertaking. In 1891, the Urban District Council apparently desired to purchase. The Council considered the matter, and also whether, the Company being non-statutory, they should seek authority themselves to supply gas in competition with them. Negotiations took place; but, on the Company making the somewhat reasonable suggestion of arbitration, the Council retired. In 1900, the Council made up their mind to apply for an Order under the Electric Lighting Acts; and the Company determined to oppose them. Negotiations for the purchase of the concern again ensued, and, again, on the Company offering to go to arbitration, the Council declined. In these circumstances, the Company felt tolerably sure they would remain in possession of their undertaking; and they therefore determined to set their house in order. They prepared for extensions; and they prepared for a battle royal with the Council if the latter went on with their application for an Electric Lighting Order. Mr. Cash was called in to go thoroughly into the accounts, and to advise as to their position from a financial point of view. Until then, the Company had kept very little more than a sort of cash account. They had been constructing works out of revenue; and a large sum of money which might have been distributed among the shareholders as dividends had been spent on works, and was represented in the works to-day. Mr. Cash found that they had spent a large sum out of revenue (beyond the capital of £6000) on capital account, and that there was a large cash balance. The result was the declaration in 1902 of a bonus dividend of 100 per cent. by the issue to the shareholders of additional shares of the nominal value of £6000—thus raising the capital to £12,000, as stated. If the Company had been statutory, the Council might have said that was an improper transaction; but as they were not a statutory Company, they were at liberty to divide every penny they made. It did not really matter for the purposes of the arbitration what their nominal capital was. From the beginning, the Company had been and were very successful; and their works were in excellent order and substantially new. They were now supplying the urban district of Nantwich and three parishes outside. There was ample room for expansion in this area, because they were not supplying nearly the whole of it. They promoted a Bill in 1903 with the object of becoming statutory, and to enable them to supply within the same limits as the Urban District Council, by their Bill of the same year, proposed. The two Bills formed the subject of negotiations; and in the end, the Company's Bill was withdrawn and the Council's measure allowed to proceed. While Mr. Cash was investigating the accounts of the Company, Mr. Corbet Woodall looked into their affairs from an engineering point of view; and Counsel did not think now that either on one side or the other would a word be said against their engineering position to-day. The financial condition of the Company was clearly shown by the tables to which, as figures, the other side had agreed; the account year being the one ending June 30, 1903. In the year terminating on June 30, 1901, the receipts from the sale of gas were £5567, in the next year £5475, and in the account year £5667. Besides these sums, there were receipts from the rental of meters, stoves, and prepayment fittings, residual products, and transfer fees. The working expenses in these three years were £4279, £4552, and £4465 respectively. The profit ranged from £2626 in 1901, to £2135 in 1902, and £2450 in 1903. The profit per 1000 cubic feet of gas sold was 21·77d. in 1901, 16·78d. in 1902, and 18·69d. in 1903. The total gas sold dropped from 22,128,000 cubic feet in 1897 to 20,216,000 feet in 1898. Since then it had steadily risen; and in 1903 it was 29,770,600 cubic feet. Thus, although in the first two years there had been a reduction in the ordinary consumers, this had been more than counterbalanced by the addition of prepayment consumers. Formerly the Company used to allow a sliding scale of discount according to the quantity taken; but for the last half year included in the accounts a sliding price was used. The result was that in the account year there were six months when one system was in vogue and six months when the other was in operation. The accounts had been adjusted to meet this variation. In 1903, there were only three consumers who took over a million cubic feet, and two who took over half-a-million feet. Since making up the accounts for the year to June 30, 1903, another half year had been completed; and the figures for this period showed that the position of the Company was improving, and was indeed better than they had supposed it would be. In starting the valuation, the witnesses took the profit for the year 1903, £2450. In that year there was a bad debt of £35 6s. 5d.; and as this was much more than usual, the average of the last three years was taken—viz., £12 11s. 11d.—which left £22 14s. to be added to the profit. The item "auditors" had against it £50 14s. 3d.; but as Mr. Cash was retained at a salary, the estimated annual charge was put down as £30—the extra expense in the year being caused by additional work in connection with the Bill in Parliament. This left another sum of £20 14s. to be added to the

profit; making a total of £2493. Applying the new method of charging in one half of the year to the other half meant a deduction of £35; leaving £2458. The repair and renewal of works, mains, &c., in the year of account amounted to 5·19d. per 1000 cubic feet sold. The Engineers, however, held that this was excessive, and that it should be 4·5d., in which case there would be an addition to the profit of £91. In the same way they reduced the figure of 1·09d. for repairing, renewing, and refixing meters to 0·5d., which meant a further addition of £76 16s. Adding these two figures to the £2458 produced £2626 13s. 11d.—the net maintainable income of the Company. With regard to the number of years' purchase, Mr. Valon said 25 was fair; while Mr. Henry Woodall thought it should be 26⅔. Beyond the capitalized value of the net income, there was the profit on gas fittings, which had been increasing for years; and, in the account year, this amounted to £185 15s. Here, again, there was a difference between the Engineers—Mr. Valon asking three years' purchase, while Mr. Woodall said this was a valuable adjunct to the main business, and should therefore be taken at five years. Then there was a claim for surplus works. The Company had works sufficient to meet the wants not only of the present area, but of the area which they had proposed to supply, even after allowing the usual margin for contingencies; and these Mr. Valon and Mr. Woodall both estimated to be worth £7626.

Mr. *W. Cash*, examined by Mr. VESEY KNOX, said when he was called in to examine the accounts of the Company in 1901, they kept nothing but a cash account. He assumed that the share capital at that date—£6000—had all been spent on work. Going back for the four years preceding June 30, 1900, he ascertained that the capital expenditure had been £2376. He then brought into the accounts, for the first time, the stocks, debtors, and liabilities, and treated the reserve fund as a reserve and the balance as accumulated and undistributed profits, as it undoubtedly was. The balance then was £5132, besides which there was a reserve fund of about £2000. This had all been earned by the Company, and might have been distributed from year to year in dividend. It was carried forward to the credit of profit and loss account. From then the books had been kept in the ordinary way. With reference to the bonus dividend of 100 per cent., amounting to £6000, issued in the form of shares, he pointed out that the whole of this sum had been spent on works and plant. Taking £21,276 as the capital employed in the undertaking, the figure per million cubic feet of gas sold was £676 10s. 4d.

In cross-examination by Mr. BALFOUR BROWNE, witness said in the year when the 100 per cent. bonus dividend was paid, a dividend of 14 per cent. was also declared. The present price of gas, 3s. 9d., was not too much to charge, because at this figure they were making a profit.

Mr. *W. A. Valon*, examined by Mr. HONORATUS LLOYD, said he had visited the works of the Company. The retorts were all in good working order. During the maximum week of 1902, the make of gas was 1,152,900 cubic feet; giving a daily average of 164,700 feet. The maximum daily make on Dec. 10 was 173,500 feet. In 1903, the maximum week's make was 1,021,300 cubic feet, and the average daily make 145,900 feet. The maximum daily make on Dec. 9 was 174,200 cubic feet. Witness went on to give details of the various plant. The structural valuation of the concern, made in conjunction with Mr. Henry Woodall, was: Land, buildings, and plant, £21,552; mains and services, £4297; ordinary meters, £743; stoves, £1025; automatic meters, £2207; and railway waggons, £201—a total of £30,025. The works were in good condition, and equal practically, without addition, to giving double the present supply. In his valuation, he started with the £2450 5s. profit for the year to June 30, 1903, from which he had deducted the agreed figure of £35 0s. 10d., due to the change in the method of charging in one half of the year; leaving £2415 4s. 2d. The repair and maintenance of works, &c., cost in the account year £681 0s. 3d., or 5·19d. per 1000 cubic feet of gas sold. Witness held that 4·5d. was ample for the purpose; and this figure applied to 31,456,000 cubic feet, the make in that year, amounted to £589 16s., so that there was £91 4s. 3d. to be added. Repairing, renewing, and refixing meters, including depreciation, cost £142 6s. 9d. As a general rule, ½d. per 1000 feet was ample, which, on the same sale of gas, would amount to £65 10s. 8d.; so that a further sum of £76 16s. 1d. had to be added to the profit. Bad debts in the account year equalled 0·27d. per 1000 cubic feet sold, or £35 6s. 2d. This was excessive, and he therefore took the average of the past three years—viz., £12 11s. 11d.; giving £22 14s. 3d. to be added to the profit. After making these and other adjustments, the total maintainable profit for the year came out to £2626 13s., which, seeing that the Company were in an extraordinarily good position to earn a dividend, he capitalized at 25 years' purchase, producing £65,666. To this he added a further 10 per cent.—the sale according to the Act being compulsory—making £72,232 17s. 6d. Beyond this, there was three years' purchase of the fittings profit (£185 15s. 6d.) £557 6s. 6d., and the net amount of surplus works £7656, which, added to the £72,232 17s. 6d., brought out his final figure of £80,446 4s. His valuation of excess works and plant amounted to £8021. Deducting £365 for deficiencies left £7656.

Tuesday, Feb. 23.

Mr. *Valon* in cross-examination by Mr. BALFOUR BROWNE, said in estimating the surplus coal storage he took as a proper allowance for the present output six weeks average; but the Company had sufficient for six weeks maximum. In regard to retorts, he assumed that No. 2 retort-house was all in excess. He allowed £34 per 1000 cubic feet for gasholder capacity—the actual cost. The bulk of the mains were 2-inch, 3-inch, or 4-inch; and 3-inch and 4-inch pipes were very serviceable. If they had been down 70 years, they ought to be in good condition.

Mr. BALFOUR BROWNE: Look at the gas unaccounted for. I find in June, 1897, there was only 2·5 per cent. unaccounted for; then it went up to 6, 4·9, and 11·9 per cent. This looks like unsatisfactory mains, does it not?

Witness: It may be due to something entirely different from the mains.

I ask you whether, under these circumstances, there ought not to be a large reduction on account of old small mains?—I have no hesitation in saying no.

Now, suppose the Company, without any change at all, get a statute? What number of years multiplier would you apply?—28½ years.

In further reply to Counsel, witness said the price the Company were charging for gas was proper, and not excessive.

Counsel proceeded to put to witness the cases of a number of adjacent towns where the price charged for gas was said to be less than that being charged by the Nantwich Company; but witness adhered to his opinion that the price of the Nantwich Company was not excessive. He agreed, however, that, in the future, the price might be reduced. This would not affect the profit. He had capitalized the income at 25 years' purchase. Asked whether he had ever before applied a multiplier of 25 to a non-statutory company, he referred to Malvern Link in 1898, where he used the figure of 26⅔. In that year, the value of money was very different from what it was now; and this would account for a difference in the number of years' purchase. The 10 per cent. for compulsory sale represented something which should be in the hands of the Umpire to allow as he chose. It was an arbitrary figure.

In re-examination by Mr. HONORATUS LLOYD, witness said the leakage had reduced the profit; and if the leakage was reduced, the profit of the Company would be higher. It was impossible to compare the prices charged by companies unless regard was had to the circumstances.

Replying to questions by Mr. STEVENSON, witness said he calculated that the whole of the works would be in use in six years, assuming the increase in consumption at 8 per cent. per annum. In 1902 and 1903, the rate of increase had been diminishing. In these years, the Company had been under the shadow of the present proceedings, and had left things alone. If the district had been developed as it should be by proper canvassing, there would be no difficulty in obtaining the 8 or 9 per cent. They had recently put on 612 prepayment meters; but the district had not reached the point of saturation. If he had been advising the Company, he should not have taken notice of the likelihood, if the Company continued to exist, of the competition of electricity. He did not think that such competition would damage a gas company at all.

Mr. *Henry Woodall* said the price charged for gas in Nantwich was very fair and reasonable compared with the prices in the immediate vicinity. The price to prepayment consumers was in very few places lower than that in Nantwich—viz., 4s. 2d., which included fittings and meter. The works had been practically doubled in the last three years; they were in first-rate order; and there was room on the site for further extensions. In 1899, the rate of increase was 8·61 per cent.; in 1900, 11·81 per cent.; in 1901, 11·17 per cent.; in 1902, 5·02 per cent.; and in 1903, 3·45 per cent.—the compound increase for the five years being practically 8 per cent. There had been £30,000 spent on the works; but the capital in the balance-sheet was only £24,000. He was jointly responsible with Mr. Valon for the structural valuation the latter had put in. His valuation of the surplus works was somewhat higher than that of Mr. Valon.

In cross-examination by Mr. BALFOUR BROWNE, witness said the number of prepayment meters fixed had decreased in the last two years; but he doubted whether the Company were exhausting their field. If a statutory company was worth 28½ years' purchase, it would depend to some extent upon the condition of the Money Market at the time it was sold. A non-statutory company was as secure as a statutory one, except as to the cost of obtaining an Act, because Parliament never permitted competition. He allowed the two years' purchase to represent the difference in the position of a non-statutory as compared with a statutory company. The 10 per cent. allowance for compulsory sale applied to the surplus works as well as the other portion of the undertaking.

Mr. STEVENSON: You think that 26⅔ years' purchase ought to be asked here?

Witness: Yes.

This closed the evidence for the Company.

Mr. BALFOUR BROWNE, in opening the case for the Council, said the extraordinary proposition with which Mr. Lloyd seemed to start was that this limited liability Company was in such a strong position that it was entitled to give gas of any quality it liked, to charge anything it pleased, and to divide any amount of profit it chose. But the fact was that the Company was being ousted from its position, because it had not been looking after the interests of the public but simply after the interest of its shareholders. A claim was made for £8000 for surplus works; but this plant had no value unless it brought an income. The Company must show there would be a demand for these works—otherwise they would be a white elephant; and this they had absolutely failed to do. The increase had become slower and slower, and competition was imminent. They all knew, despite what Mr. Valon said, that electricity was a most formidable rival to gas; and the Local Authority here had a Provisional Order for the supply of electricity, so that had the Company gone on, it would inevitably have had to face competition. But what great resources had the Company, even in the absence of competition? Although the Company had existed since 1869, there were still 700 houses unsupplied. Even the penny-in-the-slot consumers must be played out, because the increase in that method of consumption had gone down. He complained of the monstrous proposition that the Company was worth what it had earned. It was worth what it could honestly earn. To divide 14 or 15 per cent. regularly and give a bonus of 100 per cent. was not dealing fairly with the consumers. He pointed out various ways in which a non-statutory company was in an inferior position to a statutory undertaking, and stated that there was nothing to prevent a local authority, if it could provide gas-works out of the current rates, competing with a non-statutory company. The Company took great credit for spending on the works large sums from revenue which they could have divided. Every company was entitled to a fair return; but no company was entitled to charge exorbitantly for gas and put away a large amount (which they called revenue) to capital account in order to conceal it, and to divide enormous dividends. If the Company had gone on, they could not have continued to charge an enormous price and pay

enormous dividends. Then it was absurd to claim cash for surplus works when they would not be used for years. Some of the land was surplus; but against the valuation of £500 per acre, they had to put the fact that some land close by had been sold for £100 per acre. Having regard to the large profits of the Company, and comparing it with the companies around, they ought to have reduced the price of gas at least 7d. per 1000 cubic feet. This 7d. per 1000 feet upon the sale of 31,456,000 feet equalled £917 9s. 4d., which, with other minor deductions, would reduce the income to £1480. In considering the multiplier, they must remember that money had gone down enormously. It had fallen by more than 1 per cent. If it were only 1 per cent., it would change the 25 years' taken by Mr. Valon to 20, because 1 per cent. represented 5 years' purchase. Mr. Hunt adopted the figure of 19½ years; and this, applied to £1480, brought out £28,865. With regard to fittings, was it not fair to give the profit of the last three years instead of taking that of last year, £185, and multiplying it by three? As to surplus works, the Council's witnesses held that, beyond a fair stand-by, there was a certain amount of surplus. This was valued at £4646. As these works, however, would not be used for a long time, only half their value was allowed; and there were certain deficiencies to be made good, which reduced the surplus works to £1616. Thus the total valuation came out to £30,863. With regard to the allowance for the sale being compulsory, this must represent something; and the only thing to be provided for here was the cost of reinvestment, which would be covered by 1 per cent.

Mr. *Charles Hunt*, examined by Mr. BALFOUR BROWNE, said the works of the Company were fairly convenient for the distribution of gas. His valuation of the surplus works was £4646. From this he deducted, in respect of the deferred value of the surplus, one-half—viz., £2323, in respect of a duplicate exhauster and engine (less an allowance for the surplus of existing plant) £93; shed over purifiers, £144; renewing mains and services, £400; and candle photometer and preparing room, £70—a total of £3030. This, subtracted from the £4646, left £1616. The total capacity of the gasholders was 256,000 cubic feet, against a requirement of 174,000 feet. This gave an excess storage of 82,000 feet, which he priced out at £28 per 1000 feet—giving £2296. A table was handed in by witness containing particulars of the gas supply at the neighbouring towns of Frodsham, Hoylake, Knutsford, Middlewich, Runcorn, Northwich, Wilmslow, and Nantwich, which convinced him that the prices charged at Nantwich were too high. Therefore, if the Company had gone on trading, they would have had to reduce their charge for gas, which would have lowered their income. He considered 19½ years' purchase a full allowance for a non-statutory Company, having regard to the present condition of the market.

In cross-examination by Mr. HONORATUS LLOYD, witness said he had not made a structural valuation; but he considered the one made on behalf of the Company required reducing. Very little more than £24,000 was invested in the works. If the retort-house and retorts actually cost £2227 instead of his figure of £1960, his valuation should be corrected to this extent. Probably the Company had never used all the retorts in the old house; but they had to add 15 per cent. as a stand-by.

Wednesday, Feb. 24.

Mr. *Hunt*. in further cross-examination by Mr. HONORATUS LLOYD, said he could not give a definite time when the excess works were likely to be employed, and therefore he thought the best way was to halve their value. He could not see that there was any prospect of considerable increase in the consumption. Counsel then questioned witness at length with regard to the list of adjacent places on which he based his claim for reduction of the price, suggesting that they showed rather that the charge at Nantwich was a fair one; but witness maintained that, with one exception, where the circumstances were very unusual, they pointed to the necessity of a reduction. He agreed that, even if the price had been reduced by 3d., the figures of the second half of 1903 showed that the profit of the Company would still have been maintained, without regard to any ultimate increase of business. Under the Act, the sale of the Company was to be deemed to be by compulsion; but he gave no effect to that. He left it to the Court. He had never yet added a sum for compulsory sale. No doubt something should be added.

By Mr. CORBET WOODALL: His general experience was that the consumption of gas had fallen off in the last two years; but not nearly to the same extent as in the case of this Company, Asked whether, therefore, it was fair that the Company should receive nothing for the works they had provided, he said he thought the present circumstances must be taken into account. The Company took the risk of the last expenditure. The Council were now taking over an altered condition of affairs.

Mr. *A. Whittingham*, Clerk to the Nantwich Council, gave particulars of the area and rateable value of the district. He saw no prospect of the town increasing either in trade or population. There had been complaints both as to the quantity and quality of the gas; and applications had been made to the Council to provide electricity. He thought the electric light would be established in the town; and there was an application to Parliament this year to include Nantwich in the district of a Power Company. The gas-works were being re-assessed; their total rateable value now being only £446 15s. The total rates amounted to 6s. 2d. in the pound.

Mr. *W. F. Newey*, Engineer and Surveyor to the Nantwich Urban District Council, said he had seen the gas-mains at a number of places where the roads had been opened, and, generally speaking, their condition was bad. The gas of the Company, when burnt in incandescent mantles, smoked the mantles; but he was not prepared to go into the question of whether that was caused by the gas being of bad quality.

This closed the evidence.

Mr. BALFOUR BROWNE, in addressing the Court on behalf of the Council, said it was evident that Nantwich was stagnant. No evidence had been given as to the growth of the place; the other side relying upon the statement contained in the preamble of the Act. No doubt the same words appeared in the Bill promoted by the Company; it being usual to put such words in every Act. There was a poor prospect for the Company, which, no doubt, had overspent itself. They had shamelessly maintained the price of gas. It was all very well to say they could pay unlimited dividends; but it was wrong to bleed their consumers by charging such a high price. It was a disgrace that they should divide enormous dividends of 15 per cent. and give a bonus of 100 per cent. besides. Obviously they could not have gone on doing this; they would have had to reduce the price of gas. After referring to several items, he stated that the re-assessment of the works would result in a rateable value being given them of £1875, instead of £446 (the present ridiculous figure); and with rates at 6s. 2d. in the pound, they would have to pay £476 a year more to the Local Authority. To this extent therefore their income would be reduced. He asked the Court to come to the conclusion that, on the whole, the maintainable revenue was, as stated by Mr. Hunt, £1480.

Mr. HONORATUS LLOYD, in reply, observed that if hard words, insinuations, and charges could win the case, his learned friend deserved success. He was willing that the undertaking should be tested on a sound commercial and moral basis; and he held that so long as they supplied at a reasonable price, as they were doing, they were justified in dividing all that came to their hands. He complained most bitterly of the way in which the valuations on the other side were made. It was not that the amount the Company earned was too large for the capital, but that the capital was too small for the profit earned. It was said that the price of the Company should be reduced by 7d. per 1000 cubic feet. This was the *crux* of the case. But to suggest that an income in hand should be cast to the winds on an *ipse dixit* of this kind was about the most monstrous proposition ever submitted to a tribunal. The Council were actuated by one motive only—a desire somehow to dissipate the profit of the Company. They could find no sort of justification or principle to warrant what they had done. There would have been good ground for making a claim for prospective profit, because the Council were going to use the excess works to meet the demand which, he still maintained, was coming. But because he simply asked to be repaid the cost of the excess works, the Council turned round and said the works were never likely to be used. On what earthly principle had Mr. Hunt proceeded? Why had he only taken, as being in excess, two-thirds of the retorts in the second retort-house? He said part of these retorts were required as a stand-by; but this was not so, because at no time had all the retorts in the old house been used. As to the allowance for compulsory purchase, he agreed that there was no Act which said the Umpire should make an allowance for the sale being compulsory; but so universal had such an allowance become, that the practice had grown up of saying in certain cases—that no allowance should be made. But here the words were inserted: "The purchase shall be deemed to be by compulsion." Therefore the obvious inference was that an allowance should be made. In conclusion, he asked the Umpire, in view of the line adopted by the Urban District Council, to visit the works before making the award.

The Umpire reserved his award, and the proceedings terminated.

EAST DEREHAM GAS SUPPLY.

Local Government Board Inquiry.

Application having been made to the Local Government Board by the East Dereham Urban District Council, for authority to purchase, deal in, and fix gas stoves and fittings and borrow more money, Mr. F. H. Tulloch, M.Inst.C.E., one of the Board's Inspectors, recently held an inquiry into the matter. Under the Council's Provisional Order of 1885, their borrowing powers were limited to £15,000, out of which they had raised and reborrowed £13,079; leaving only £1921 for all further contingencies; and it was suggested by the Local Government Board, in answer to a question by the Council, that while they were applying for powers to let out stoves, they might ask for further borrowing powers, so as to save the expenses of another Order. The date for the commencement of letting out stoves was 1880; but it appeared that the Council had no power, under their Order, to purchase or let out stoves, &c., though they had been doing so. The Clerk (Mr. B. H. Vores) wrote to the Board, asking under what powers they could let out stoves; and the Department, referring to the Order, found that they had no such power. The number of stoves out on hire on the 31st of March last was 171, and the account received for the sale of gas for cooking purposes during the year was £493 10s. 2d. The Clerk having read the notice calling the inquiry, the Inspector said he was aware of the circumstances under which it was being held. The Clerk then asked that the power to borrow should be unlimited; £10,000 had been mentioned, but this was only suggested at a Council meeting. There was still a sum of £2000 to be borrowed under the old Order. The Inspector remarked that Dereham was not a very big place; and the £15,000 had lasted some years. Therefore there was no reason why the borrowing powers should be limited or unlimited. How long was it thought the £10,000 would last? In the ordinary course of events, the Clerk said it would last another 30 years. There being no one present to oppose, the Inspector proceeded to inquire into the further application of the Council to borrow £1921 for the erection of a gasholder; and, in answer to a question by him, Mr. H. Kitson, the Gas Manager to the Council, stated that he was confident the work could be carried out for the estimate he had prepared. It was mentioned that two members of the Council were of opinion that a gasholder of 50,000 cubic feet capacity would meet their requirements, and that there was no necessity for a 70,000 cubic feet holder as was suggested. The Clerk said it was the only available spot of land on which the Council could erect a holder. If they put up one to hold 50,000 cubic feet, they would never be able to erect another on the same site. It would be rather a short-sighted policy to spoil the site for the sake of a few cubic feet. The Chairman of the Council (Mr. G. Brett) said the matter was considered by them, and they found that, with a comparatively small increased cost, they could get half as much more capacity. The inquiry then closed, and the Inspector visited the works.

BROMLEY GAS CONSUMERS' COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held last Tuesday, at the Bell Hotel, Bromley—Mr. ALEXANDER DICKSON in the chair.

The SECRETARY (Mr. H. W. Amos) read the notice calling the meeting; and the Directors' report and the accounts were then taken as read.

The CHAIRMAN, in moving their adoption, said he had first to felicitate the shareholders upon the increase of 5 million cubic feet in the make of gas, and 5¾ millions in the quantity sold during the half year, in comparison with the corresponding period of 1902. It might have been observed that the unaccounted-for gas was less by 750,000 cubic feet, and that so much more was found in the quantity registered by the meters. The make per ton of coal carbonized had been well maintained; and the sales of coke and sulphate of ammonia had been more productive. Their business, too, through the automatic prepayment meters, was now well established, and was extending. These were all factors tending to promote the permanent prosperity of the undertaking. Whatever might be the extent of business their competitors were doing, they at least were not preventing the development of the Gas Company. The last ten years had been a crucial decade in the fortunes of the gas industry. The adaptation of electricity for house lighting had necessitated the transition from gas lighting by combustion burners to the infinitely superior and more economical mode of incandescent radiation, and had engendered a competition in which, *qua* illumination, gas had incontestably outshone its compeer and beaten it in price. During the first years of the advent of electric light in private houses, its novelty and seeming facilities for use secured its adoption by many who had previously used gas. And generally a great retard in the rate of increase of gas consumption was experienced wherever electricity was available. But subsequent improvement of incandescent gas mantles and burners had shown what efficiency and economy the new system could produce; so much so that one now heard of those who were abandoning or limiting the use of the more costly light, and were resorting to incandescent lighting by gas instead. The development of gas for heating and cooking purposes, and its sale in smaller quantities for cash payments, had also largely promoted its popularity. The improvements in these directions already evolved by the healthy rivalry of the two interests would confer wide and lasting benefits on both gas companies and consumers. In the matter of street lighting, too, it was at first said that the new comer would reign supreme; but in that field also, the improvements effected in the lighting possibilities by gas (of which Bromley furnished a most satisfactory example) had not only retained its use, but were elsewhere leading to its reinstatement in places where it had been superseded. During this time, too, the sale of gas had been seriously hampered by the greatly increased cost of coal, especially during the last four years, which rendered it very difficult, in cases of companies like their own, to effect any great reduction in price—the one essential for sustaining its lasting superiority. An appreciable advantage in manufacture had been attained by the introduction of machinery for charging and drawing their retorts, and quite recently improved appliances of this kind had been brought into use, which promised to give even more economical results. This brief retrospect might not be devoid of interest to the proprietors and their co-partners—to the proprietors as reassuring their confidence in their investment, and to the consumers as indicating to them the certainty of the Company being able to furnish them with that great facility in domestic and trade purposes, a good and cheap light, and a gas which could, through the cheapened appliances, be generally used for cooking and heating. The first desideratum to that end was a cheaper raw material. Coal had been costing at the pit mouth from 40 to 50 per cent. above the prices prevailing before 1900—both coalowners and coal workers offering sturdy disinclination to concede reductions to what used to be normal prices and normal pay. But there were indications that gas-coal contracts for next year would be somewhat more favourable than recently. Again, the best efforts of the Directors would be used to obtain a further reduction; and, should they succeed, the question of the price of gas would have their earliest consideration. Contrasting the present accounts with those for the half year to Christmas, 1902, it would be seen that the gas and meter rentals had yielded £21,208, as compared with £20,629, notwithstanding the reduction of 1d. in the price of gas. Coke had produced £5412, as against £4916; sulphate of ammonia, £1024, against £911; tar and breeze, £740, against £754. Rental on fittings and stoves rose to £641, against £541. With other slight variations, the half-year's income became £29,193, against £27,911—being an increase of £1282. On the expenditure side, coal cost £10,710, against £10,791—the small advantage obtained in the price over the previous year being in these figures set off by the charging of certain yard expenses to "coal," instead of to "wages" as formerly. Wages, partly for this particular reason, and partly from their not having to use No. 1 retort-house with manual stoking last summer, appeared as £1193, instead of £1628. The item of works, machines, retorts, and general repairs was £3455, against £2401. Salaries were £1402, against £1242. In regard to this item, the salaries of the Engineer and clerks at the works would in future, as now, be included (where it should come) under manufacture of gas, instead of under management. Then repairs to meters, services, and stoves amounted to £707, against £911; and fittings on hire to £534, as compared with £463. Public lamps absorbed £784, against £455. For rates and taxes, £933 was paid, instead of £1064. The other items were also compared by the Chairman. The Directors, he continued, had written off £62 for legal expenses—being the Company's agreed contribution to the joint opposition of the Crystal Palace Gas Company and their own Company to the Bill of the Beckenham District Council. It would be remembered that the Lords Committee inserted in the Bill a clause protecting the Gas Companies against damage to their pipes from electrolysis; but the clause was expunged from the Bill in the House, upon the report stage. Then in these accounts there was the amount of the stamp duties exacted from the Company on the alleged increase of their capital upon the conversion of the shares into stock (although by that conversion the cash capital was not augmented by a single penny), and also the whole duty payable upon the authorization of the additional capital, although that capital might not be issued in full for possibly many years to come. The duty, which had to be paid directly the Act was passed, had now been charged to the revenue account; and the capital account had been relieved of the like amount. It was only due to their careful and expert Auditors that he should explain that there was a clause in the Company's Act of 1902 expressly directing that the costs, charges, and expenses incidental to the passing of the Act should be paid out of the capital funds of the Company. This language appeared to the Auditors, as to the Directors, to include this payment, as would be conceded in the case of the promotion of a new company under the Joint-Stock Companies' Act. But the contrary view having been taken in two or three somewhat similar cases, the Board thought it much better to write off and get rid of the cost, which was practically a contribution to the general revenue of the country like any other stamp duty, and which was unattended with any addition to the capital assets of the Company. In this way, the total expenditure of the half year stood at £21,436, against £19,805 for 1902; being an increase of £1631. There was thus a lesser balance of £348 to go to the profit and loss account; but the net profit on the half year was nevertheless sufficient to cover the payment of the same dividends as last time, and to add the small surplus of £137 to the undivided profit balance to be carried forward. There was only one other matter to refer to, and that was the question of rating. Nine years ago, the Company's undertaking was reassessed for rating purposes by an eminent London firm acting on behalf of the rating authorities of the Union. Four years after it was again reassessed by the same firm. Last year, the Union authorities, after so short an interval, called in another firm of surveyors, and served the Company with notice of an increase of the rating from £5114 to £8300 odd, or over 62 per cent. increase on the existing valuation—an increase which, if confirmed, would exact from the Company a contribution of fully another £1000 a year to the rates of the district. Their total payment to the rates last year was £1750. This was a very serious additional burden which it was proposed to put upon the Company. He need not say the Directors had objected, and had also retained professional expert assistance to resist what they felt to be an incorrect and unfair valuation. But as the matter was still *sub judice*, he proposed to defer to a future occasion further observations and criticisms upon it.

The DEPUTY-CHAIRMAN (Mr. B. H. Latter) seconded the motion.

Mr. SUTTON asked whether the Company's investment in Consols ought not to be written down to 86.

The CHAIRMAN said the Board had anticipated a possible reference to this subject by a note which they had appended to the reserve fund. It would be seen that it was there stated the fund was invested in £7274 13s. 2d. of 2½ per cent. consolidated stock; the quotation value of which, on Dec. 31 last, was 88 per cent.

The motion was unanimously carried.

A resolution was then passed declaring a dividend at the rate of 6 per cent. per annum on the 5 per cent. "A" ordinary stock, and at the rate of 4½ per cent. per annum on the 3½ per cent. "B" stock, both less income-tax.

The retiring Directors (Messrs. S. J. Wilde and Hugh Wyatt) and the Auditor (Mr. E. E. Price) were re-elected.

The customary complimentary votes ended the proceedings.

BOURNEMOUTH GAS AND WATER COMPANY.

Further Capital to be Raised.

The Sixty-seventh Ordinary General Meeting of this Company was held on Friday, at the London Offices, No. 90, Cannon Street, E.C.—Mr. G. CRISPE WHITELEY in the chair.

The SECRETARY (Mr. William Cash, F.C.A.) read the notice convening the meeting and the minutes of the previous meeting.

The report for the half year to Dec. 31 (which, with the accounts, was taken as read) stated that during the period under review the Company had acquired the property at Poole as contemplated by their Act of 1903, and had also entered into the proposed agreements with the Poole Corporation and Harbour Commissioners in relation to the projected works. Apart from the land acquired, capital expenditure had been incurred almost entirely on mains, meters, and fittings necessary to cope with the extension of the business. Both for the erection of the works authorized at Poole and for extensions generally, further capital would be required to be raised in the near future. The sales of gas and residuals showed a satisfactory growth throughout the whole district. The accounts included the transactions in the Poole district for six months, as compared with three months in the corresponding half year; while gas had been sold at 2d. per 1000 cubic feet less than in 1902. Mention was also made of the fact that the Company are now working the show-rooms entirely on their own account. These circumstances rendered a comparison of the results somewhat difficult; but in the opinion of the Directors they were satisfactory, while the supply of gas and water had been efficiently maintained. After payment of all charges, and adding £1000 to the reserve fund, there remained available for distribution a sum of £20,632; and the Directors recommended that dividends be paid of 6, 7, and 13 per cent. on the preference, "B," and original shares, respectively, and that the sum of £7248 should be carried forward to the next half year.

The CHAIRMAN said he need not detain the shareholders very long, because, in accordance with their more modern custom, the report itself dealt with the more salient features of the past six months. They had now acquired the property at Poole which was necessary for their new works, the carrying out of which would soon be commenced. The Bill which they were fortunate enough to pass through Parliament last year, would, of course (as they hoped), place the Company in an even stronger position in the future than had been occupied in

the past; but, at the same time, it placed upon their shoulders increased responsibility, increased anxieties, and increased expenditure—which latter they trusted would be of a remunerative kind. They would see from the accounts what the cost of the Act was (£1698); and he was bound to say that the expense of the passage of such measures through Parliament did not seem to get less. They had been in Parliament twice during recent years—he might say with success; and he only hoped that the money thus spent had been spent wisely and well. But anyway the cost entailed was a large one; and the less frequently they had to incur it, the better it would be for the Company. At all events, they did not intend to go recklessly to work in this direction. The taking over of the Poole district had strengthened the Company and enlarged their sphere of labour; and when he told them that during the few months they had been at work since the acquiring of this area, the increase in the business had been more than 38 per cent., he thought they would be exceedingly gratified. It showed, on the one hand, that they were spending money; and, on the other, that they were making the expenditure very highly remunerative. When looking through the accounts, he would ask them to remember that gas was now cheaper. They had had the pleasure of reducing the price—and it was a pleasure, because if done in a reasonable way it generally led to an increased consumption. At all events, it enabled the Company to fight with a stronger hand the incessant battle they were having with other methods of lighting. This battle was now getting into a very—he would not say critical state, but it was certainly about as fierce as anything could be. The Company were not hesitating to take their share in it. They were not resting content with jogging on in the old way, but were trying a dash into the enemy's territory—more for the purpose of protecting themselves than for anything else. They had records of no less than eighteen recent cases in which they had succeeded in installing gas in important places in Bournemouth, after electricity had been adopted. This showed that they were not content with taking the remains of other people's business, but were going to keep what they had got, and at the same time maintain a fair and reasonable contest with what he might, in a friendly way, term their commercial enemy. While, of course, the electric light people were fighting them and saying very hard things about the disadvantages of gas and the advantages of electricity, it did not do to mind hard knocks in a struggle like this. When their Engineer had shown him some of the electricity circulars, he (the Chairman) had pointed out that they themselves were issuing circulars of a like kind, and that they must be prepared to take knocks as well as to give them. With regard to cookers, there had been a very satisfactory increase. He mentioned this because to a certain extent it was connected with one of the items in the accounts which it might be thought was rather high. They would notice in the revenue account that stationery and printing and incidental expenses were growing; but while this was undoubtedly the case, it only meant that the Company were doing a larger business. Not only did this necessitate more extensive purchases of stationery and books, but they had also sent out a nice little *brochure* on "Gas Cooking;" and they had every reason to believe that this pamphlet had something to do with the increase of 38 per cent. in the number of cookers that they had distributed in their district. It was not often possible to trace business so clearly as they were able to do in this case. Another change effected was that they had now taken the whole of the show-rooms under their immediate control. Of course, this would mean increased responsibility and increased work; but he believed that in the end it would undoubtedly be to the advantage of the Company. He had now dealt with the main work of the past six months. Matters had been, and still were, to a certain extent in a transitional state; and the Board were that day going to ask the shareholders to give them power to raise further capital. Without more money, they did not see how they could cope with the increased responsibilities of their tremendous district. They would use the utmost discretion in raising and spending it; and in this connection he might point out that they were doing all they could to prevent too rapid an issue of capital. They were using a considerable amount of the reserve fund in the business—much more than he would like to be the case, if it could be avoided—and they had had a large advance from their bankers. But when all was said and done, they must have a further issue of capital for their works and for their increased business; and therefore he hoped that the shareholders would authorize the Directors to raise it. Of course, the existing proprietors would, as usual, have ample opportunity of taking up the shares; and any that were left over would be secured—very greedily devoured, he might say—by those who were anxious to get a footing in the Company. The steady and satisfactory increase in business shown by the report and accounts was matter for congratulation; and he had great pleasure in moving their adoption.

Mr. R. HESKETH JONES, in seconding the motion, remarked that, as the Chairman had referred to the meeting that was to follow for the purpose of sanctioning the raising of additional capital, he might just mention that five years ago the revenue of the Company was about 18 per cent. upon the capital invested; while last year it had risen to 20 per cent., notwithstanding the reductions in the price of gas and water. He thought these facts were very satisfactory. He might further state that during the past half year, as they would see from the accounts, they had expended nearly £9000 on new land and on the Act of Parliament, which money was at the present time unproductive, and had been incurred for the future development of the Company. If it had not been for this expenditure, the 20 per cent. to which he had just referred would have been considerably increased. They were also in a position to carry over some £2500 more this last Christmas than they were five years ago; and under these circumstances, he thought the shareholders would agree with him that the Company were in a most satisfactory financial position, and that the Board were fully justified in asking for an increase of the capital.

The motion was carried unanimously; and on the proposition of the CHAIRMAN, seconded by Alderman RYMER, the dividends recommended were declared. The retiring Director (Mr. Corbet Woodall) and Auditor (Mr. F. G. Barrett) were afterwards re-elected.

An Extraordinary General Meeting was then held for the purpose of authorizing the Directors to raise additional capital in accordance with the provisions of the Bournemouth Gas and Water Act, 1896, by the issue, at such times and in such manner as they shall think fit, of 5000 ordinary or "B" shares of £10 each, and £50,000 of debenture stock.

The CHAIRMAN formally moved, and Mr. HESKETH JONES seconded, a resolution to this effect, and it was carried unanimously.

Mr. BATLEY then proposed a vote of thanks to the Chairman and Directors; and the Chairman, after acknowledging it, moved that a similar compliment be paid to the staff. He said that, from the Engineer and Manager (Mr. Harold W. Woodall) downwards, they had a most excellent staff; and it would have been quite impossible for them to have attained the results they had were it not for this fact. The energy and enthusiasm of Mr. Woodall could not possibly be exceeded. Mr. Cash also filled the position of Secretary with a zeal that was of the highest importance to the Company.

Mr. CASH returned thanks on behalf of the staff; and this terminated the proceedings.

ASCOT DISTRICT GAS COMPANY.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 50, Cannon Street, E.C.—Mr. JOSEPH MANWARING presiding.

The SECRETARY (Mr. W. A. Schultz, J.P., F.C.A.) read the notice convening the meeting; and the report and accounts were taken as read.

The CHAIRMAN said he was pleased to say that the Directors had another very satisfactory half-year's accounts to bring before the shareholders. The working results had been in every way satisfactory. The quantity of gas manufactured showed an increase on that of the corresponding half year of 2,840,000 cubic feet, or 15 per cent. The yield of gas per ton of coal carbonized was 11,160 cubic feet, against 10,839 cubic feet last year. This was no doubt due to a better class of coal having been substituted. The retort accommodation having now become somewhat limited, the Directors decided, when they renewed the last coal contract, to buy a coal producing more gas to the ton, and thus avoid the immediate necessity of increasing the retort-house. The sales of gas showed an increase of some 2¼ million cubic feet, or about 13 per cent. more than in the corresponding half year; while the amount of unaccounted-for gas was 7¾ per cent. This, considering that there were now about 40 miles of mains, must be regarded as satisfactory. The quantity of gas sold per ton of coals used worked out to 10,180 cubic feet, as against 10,098 cubic feet last year. These results reflected great credit on the Engineer, who had throughout shown himself keenly alive to the interests of the Company, and had studied its welfare in every possible way. The residual products compared very favourably; the revenue from these having been £163 in excess of last year's, or an increase of 25 per cent. The coke had realized better prices. The coke sold per ton of coal used was 9¼ cwt. The tar and liquor had also improved somewhat. The number of consumers on the books, too, was still satisfactorily growing; the reduction in the price of gas last year having helped in this direction considerably. On Dec. 31 last, the number of ordinary consumers was 626, as against 562 at the corresponding date last year. The number of prepayment consumers was 278, as compared with 234; of stoves (ordinary consumers) on hire, 186, as against 178; and of prepayment stoves, 270, as compared with 221. The price of gas was reduced 3d. per 1000 cubic feet from March 31 last; and the whole of the half year therefore bore the reduction as compared with the previous year. With this in view, he thought the shareholders were to be congratulated on the very successful and prosperous half year. He moved the adoption of the report and accounts.

Dr. H. J. STRONG, J.P., seconded the motion.

Mr. SAMUEL SPENCER, in complimenting the Board on the character of the accounts, said he had hoped, in view of the progress the concern was making, the shareholders might have had a slightly increased dividend. But, he took it, it was only a pleasure deferred.

The motion was unanimously adopted.

Mr. HENRY WOODALL, in proposing the declaration of a dividend at the rate of 5 per cent. per annum (less income-tax), said there was one gratifying item in the accounts he should like to call attention to. It had reference to the reduction in the capital account during the last few years. When he was elected to the Board, the capital expenditure was at the rate of £2300 per million cubic feet of gas; to-day, it was only £1715.

Mr. S. WHILE seconded the proposition, which was adopted.

Mr. ALFRED KITT moved, and Dr. STRONG seconded, the re-election of the outgoing Directors (Mr. F. Bridges and Mr. H. Woodall). This having been agreed to, the Auditors (Messrs. T. A. Welton, F.C.A., and Dr. Strong) were reappointed.

Mr. SPENCER proposed a hearty vote of thanks to the Chairman and Directors. In seconding, it was remarked by Mr. WHILE that he considered, before the Directors again lowered the price of gas, the shareholders should be thought of, so that their holdings might be improved in value.

The resolution was cordially agreed to.

Mr. WHILE, in moving a vote of thanks to the Secretary and Engineer, said he was quite sure the officers deserved their thanks. He thought it was a very remarkable thing that the leakage had been brought down to 7¾ per cent. on their 40 miles of mains.

Mr. WOODALL: Notwithstanding a great deal of mainlaying this half year.

The CHAIRMAN seconded the resolution; and it was heartily agreed to.

The SECRETARY, in acknowledging the vote, remarked that the balance-sheet reflected very great credit upon the management at the works; and the shareholders were to be congratulated upon having there such a man as Mr. Brooks. They had had an exhibition of Mr. Brooks's great interest in the Company. During the recent rains there was a flood at the works, and the fires were extinguished; and

it was only due to the smart generalship on the part of their Engineer that disaster was averted.

Mr. BROOKS added a few words of acknowledgment, and observed that, to his mind, the most gratifiying figure in their accounts was the relation of the capital to the business. An important difference had been made in this. Five years ago, the capital represented 44s. per 1000 cubic feet of gas; now it was only 32s.

PROVINCIAL GAS AND WATER COMPANIES.

Gas.

Good Business and Good Prospects at Aldershot.

In the six months ending Dec. 31 last, the Aldershot Gas and Water Company made a profit of £7610, out of which the Directors were able to recommend, at the recent half-yearly meeting, dividends at the rates of 11½, 8½, and 7 per cent. per annum, and place £1000 to the credit of the reserve. The Chairman (Mr. A. F. Wilson) had a satisfactory story to tell of the Company's progress and prospects. In the first place, the gas consumption had, he said, increased about 16 per cent., instead of the normal 10 per cent. expected; while residuals had gone up about 28 per cent. in value. The price of gas had been reduced 2d. per 1000 cubic feet, which would enable the Directors to pay an increased dividend on the "A" and "B" shares; but he pointed out that while the shareholders received £90 per annum, the consumers would benefit to the extent of £750. However, the Company and the inhabitants of the district were partners; and if one prospered, the others received a large share of the benefit. In the course of his remarks, the Chairman stated that the Camp authorities had been experimenting with a view to replacing coal fires with gas for cooking purposes. The public made up their minds years ago that gas was cheaper, cleaner, and better for cooking than coal; and it was satisfactory that, even at this late period, the authorities were awakening to this fact, and trying to improve the comforts of the soldiers. He expressed the hope that the experiments would result favourably to gas, and that the Company might have to supply it. The report was adopted; and the dividends recommended were declared.

Increased Gas Consumption at Barking.

The Urban District Council of Barking have an electric light undertaking on which they have expended about £40,020; and though they sold 35,000 units in the year ending the 31st of March last, the financial result after providing for the interest and sinking fund, was covered by a £20 note. This cannot be called a brilliant achievement; and it forms a striking contrast to the success of the undertaking which furnishes the older illuminant. According to the accounts of the Barking Gas Company for the six months ending the 31st of December, the revenue from the sale of gas amounted to £7224, while the total receipts were £9672. The expenditure being £5754, the balance carried to the profit and loss account was £3918. The balance available for distribution at the recent half-yearly meeting was £4017; and the Directors disposed of it by paying the full dividends (less income-tax) on the different classes of shares, together with 1½ per cent. on account of back-dividends on the original shares, carrying £300 to the meter or stove renewals fund, and placing a similar sum to the reserve account. This left £512 to be carried forward. In the six months covered by the accounts, there was an increase of no less than 31 per cent. in the quantity of gas sold, compared with the corresponding period of 1902; so that the Company are not suffering much from the presence of the rival undertaking in the hands of the Local Authority.

Meeting Competition at Barnstaple.

In spite of the energy with which the Corporation electricity undertaking is boomed at Barnstaple, the Directors of the Gas Company were able, at the recent annual meeting, to produce an excellent record of the year's work. Indeed, one shareholder said that the balance-sheet was the best the Company had ever had. They had bought less coal, made more gas, and realized more from residual products than before; and though losing a good share of one of their best customers, they were able to pay the full dividend, and carry a small sum to the reserve account. The Chairman (Mr. C. E. R. Chanter), going a little more into detail, said the revenue amounted to £9420, which was £499 less than in 1902. But £346 was due to the reduction of 3d. per 1000 cubic feet in the price of gas, and £140 to loss of public lighting; only £13 being accounted for in the loss of private lighting. Taking income and expenditure together, they had a gain of £85. There was an increase of 118 in the number of consumers; and there were 500 cooking stoves on hire—an increase of 100. The prepayment system had been developed; and they now had 505 customers of this class, and 908 ordinary consumers. Some of the existing mains would have to be replaced, as, notwithstanding the introduction of the electric light, they were becoming too small for the demand upon them.

Slot Consumers to be Considered at Eastbourne.

Dr. Jeffery, the Chairman of the Eastbourne Gas Company, had what he called a "pleasant chat" with the shareholders at their half-yearly meeting on the 22nd ult. The adjective was fully justified, for he had not only to talk of improved business, but was able to make a promise that the Company's prosperity should be shared next July by the prepayment meter consumers, whose use of gas increases. The ordinary consumers have had a reduction of 2d. per 1000 cubic feet; and the others will have 25 instead of 22 cubic feet for 1d. The sale of gas in the six months ending Dec. 31 reached nearly 178½ million cubic feet, or an increase of 4·7 per cent. compared with the latter half of 1902; while the number of consumers went up by 385—bringing the total to 7055, of which 3913 are ordinary and 3092 coin-meter consumers. The profit made in the half year was £8997, compared with £8486—an increase of £511; while the disposable balance was £21,836. This allowed of the payment of dividends at the rate of £14 10s. and £11 10s. per cent. per annum, and left a balance of £14,417 to be carried forward. The proprietors recognized the services of the Secretary (Mr. J. S. Garrard) by unanimously agreeing to the suggestion of the Directors that his salary should be increased by £100 per annum as from the commencement of the present financial year.

Elland and the Electric Light.

The Chairman of the Elland Gas Company (Rev. J. E. Aspinall), in moving, at the annual meeting last week, the adoption of the report and balance-sheet—which provided for a dividend on the ordinary stock at the rate of 6⅝ per cent. for the year—described the position of affairs as most satisfactory, in spite of the fact that the twelve months, from a gas point of view, had not been altogether good. They had had to contend against short time at many places of business, a mild winter, the absence of black fog, and electric lighting. The last named commenced in October; and, for the first time since the formation of the Company, introduced competition. It was too early yet to judge what the results would be. It was sure to affect them to a certain extent, though they did not in any way complain of the competition, so long as it was legitimately carried on. They might, however, have something to say if they were asked to contribute through the rates to a deficit caused by the sale of a competing light at less than cost price; being, as they were, one of the largest ratepayers in Elland. Such a demand must have a marked effect upon the finances of the Company, if ever made; and it would certainly be their duty to endeavour, in such an event, to safeguard the interests of the proprietors and to expose a policy which would be full of financial danger to the ratepayers at large. Another factor which tended to reduce sales was no doubt the wide adoption of incandescent lighting, which caused economy in consumption. But their policy in this matter was absolutely clear. It was to do all in their power to supply their customers with the best lamps which could be obtained, and to put them in the way of getting the best light at the least possible cost. This was the finest weapon they could employ to enable them to compete successfully, as regarded both cost and efficiency, with electric or any other light. It was a policy which had already in many places ousted the electric light. They must set themselves to prove, as he thought could be proved, that gas was both better and more effective than electricity. He might also mention a new departure in the history of the Company in this direction. They were now undertaking the complete installation of gas from the main to the burners—an advantage which was much appreciated, and which had produced a fair increase of consumers. The returns for the two months of this year were satisfactory, and fully justified the action of the Board in reducing the price of gas by 3d. per 1000 cubic feet. Should the sale of gas remain the same, this reduction in price meant a loss of income of some £1400; but he would point out that they were carrying forward an increased balance of £570 odd, and that they expected their expenditure on maintenance would be considerably lessened. They also looked forward to an increased business in consequence of the reduction in price. The report was adopted; and the Engineer (Mr. Robert Porter) and other officials were thanked for their services.

Some Interesting Topics at Exeter.

The report presented at the annual meeting of the Exeter Gas Company last Tuesday showed that the gas consumption increased during the past twelve months by nearly 10 million cubic feet, and the Directors were in a position to announce a reduction of 2d. per 1000 cubic feet in the price of gas as from Christmas last. Another matter referred to in the report was the settlement last year of the difference between the Company and the Corporation respecting the possibility of damage to the Company's mains from the proposed municipal electric tramways. A clause which the Corporation agreed to insert in their Tramways Act provides that full compensation shall be made to the Company for any loss or damage that may occur to the mains, pipes, or apparatus by fusion or electrolytic action caused by the exercise of any of the powers conferred by the Act. Mention was also made of the fact, already mentioned in the "JOURNAL," that the Company have lodged an appeal against the new assessment of the undertaking by the Assessment Committees in Exeter and St. Thomas, and that the appeal is set down for hearing at the next Quarter Sessions. The net profit last year was £10,821; and the Directors recommended payment of the usual dividends of 10 and 7 per cent. on the two classes of shares. The Chairman (Mr. R. T. Campion) congratulated the shareholders on the satisfactory condition of the undertaking, and said there had been steady progress in the business of selling gas fittings and appliances which was introduced a year or two ago when the new offices were opened. The addition made by the Assessment Committee to the valuation of the Company's properties was no less than £3000; and the Directors regarded this as excessive. He also announced that the new method of carbonizing by vertical retorts on the Settle-Padfield system, which practically made a revolution in the manufacture of gas, had been applied to the Company's works, and would shortly be in operation. It was anticipated that it would reduce the cost of working. The report and statement of accounts was adopted.

Advocacy of Gas-Stoves at Newmarket.

A considerable portion of the speech of the Chairman of the Newmarket Gas Company (Mr. R. Stephenson, J.P.), when moving the adoption of the report of the Directors at the annual general meeting on Monday last week, was devoted to the advocacy of the use of gas for cooking and warming purposes. He said the Company had for a long time urged their customers to make use of gas-cookers and gas-fires; and he thought Newmarket stood very well in this respect. But there was still room for the employment of a large additional number. He did not think the economy and comfort derived from them had yet been fully realized. With regard to cookers, the saving effected was very large; and this had been recognized by the working classes. They had 634 slot-meter consumers, most of whom had cookers. For heating purposes, no fuel was so economical as gas, as at the cost of 1d. or 2d. the chill could be taken off a room, and danger from abrupt changes of temperature avoided. In the domain of lighting, the consumers had

followed to a large extent the advice which had for years been given to them to adopt incandescent in place of the old flat-flame burners, to their own advantage and he believed ultimately to that of the Company. Turning to financial affairs, Mr. Stephenson stated that the profit on the past year's working had been £580 more than it was for 1902. The accounts presented showed a balance of £4756 available for distribution; and £3705 of it will be used in paying a dividend of 6½ per cent. —the remainder (£1051) being carried forward. The Chairman referred in highly complimentary terms to the work of Mr. J. H. Troughton, the Manager and Secretary.

Gas Supply in North London Suburbs.

Reports presented at the meetings last week of two Gas Companies serving districts to the north of London reveal the gratifying fact that there is a steady increase in consumption. The Directors of the North Middlesex Gas Company informed the proprietors on Wednesday that the sale of gas in the six months ending Dec. 31 was in excess of that of the corresponding period of the previous by 4,195,400 cubic feet, or 7 per cent. Altogether, 63,699,600 cubic feet were sold, producing a revenue of £12,046; and the rental of meters and other items brought up the total receipts to £14,450. The expenditure being £10,107, there was £4343 to go the profit and loss account, the balance on which available for distribution was £4867. Dividends were declared at the rates of 10 and 7 per cent. on the original and additional capital, £312 was placed to the reserve fund, and £1932 was left to the good. An even better report was submitted next day at the meeting of the Colney Hatch Gas Company. Compared with the latter half of 1902, there was an inrease of 5,495,750 cubic feet of gas, or 12 per cent., in the Company's district. The sale of 51,086,900 cubic feet produced £9475, and the total receipts were £11,853. The expenditure being £8441, the profit was £3412. A sum of £4853 was available for distribution, and dividends similar to those declared in the neighbouring Company were paid. They amounted to £2255, and left a balance of £2598.

Extended Business at Reading.

The report presented by the Directors of the Reading Gas Company at the meeting of shareholders last Tuesday must have been very gratifying to all concerned. In the course of the past year, there was an increase of 44,890,533 cubic feet, or 11·22 per cent., in the consumption of gas compared with 1902; 2905 new consumers (principally on the prepayment system) were placed upon the books, or an addition of 42 per cent.; and the Company's mains were extended to Tilehurst, which for the first time has had the benefit of gaslight. The Directors are fully satisfied at the able manner in which the new Engineer and Manager (Mr. Douglas H. Helps) has carried out his duties; and they have every confidence that his efficient management will conduce to the prosperity of the Company. Under his supervision, the carbonizing department has been brought up to its fullest capacity; and the supply of gas to the town has been greatly improved by the erection and equipment of a new governor-house. Other important work has been carried out in preparation for future extensions, which will become necessary owing to the ever-increasing consumption of gas for lighting, heating, cooking, ventilation, and motive power. Plans for new offices and show-rooms have been passed, and the building is to be proceeded with. The consumers were considered last year by a reduction of 2d. per 1000 cubic feet within the borough, and 4d. beyond. The sale of gas produced £64,398, out of the £91,358 received; the expenditure being £74,348, and the balance carried to the profit and loss account £17,010. The amount available for distribution was £21,620; and maximum dividends were declared. In view of the further extensions of the manufacturing plant which Mr. Helps says are required, additional capital is to be raised.

Water.

Water Supply in the Midlands.

Two Midland Water Companies held their half-yearly meetings on Thursday—the South Staffordshire and the East Worcestershire. The report presented at the former showed that the number of houses laid on during the half year ended Dec. 31, was 1933; making the total supplied 120,993. The gross amount of water-rates was £61,838, against £60,503 in the corresponding half of 1902. The amount for distribution was £24,759; and the Directors recommended a dividend of 6½ per cent., which would leave £4349 to the good. The Chairman (Mr. Frank James), in moving the adoption of the report, said he had hoped to approach 7 per cent.; but the expenses entailed in the maintenance of work prevented it. However, considering the circumstances of the time, it was by no means unsatisfactory to pay 6½ per cent. and carry forward £4349. The report was adopted. At the meeting of the East Worcestershire Company, under the presidency of Lord Windsor, the accounts presented showed a profit of £2064, which, added to £1346 brought forward, made a disposable balance of £3410. This it was proposed to appropriate as follows: To pay a dividend for the half year at the rate of 4½ per cent., and to carry forward £1868.

A Flourishing Northern Water Company.

The Chairman of the Newcastle and Gateshead Water Company (Mr. W. D. Cruddas) had a satisfactory report to present to the shareholders at their annual meeting on Tuesday. Though, in consequence of the wet weather, the demand for water for trade purposes fell off last year, there was an increase of £2017 in the receipts, while the expenses were less by £2824, owing to a decrease in the cost of labour. The gross receipts amounted to £168,931; and the profits were £131,477, against £126,634. Deducting the working expenses, interest, and the interim dividend, there remained a balance of £55,930. After payment of the dividend on the preference stock, one at the rate of 8½ per cent. per annum on the original ordinary stock (making 8 per cent. for the year), and another at the rate of £5 19s. per cent. per annum on the ordinary stock under the Acts of 1876 and 1898 (making £5 12s. per cent. for the year), there was a balance of £1214 to be carried forward. The Company have at present storage to the extent of 3060 million gallons; but when the Catcleugh reservoir is completed it will be increased to 5360 millions.

INCANDESCENT GAS LIGHTING IN WESTMINSTER.

The Works Committee of the Westminster City Council reported last Wednesday that they had considered the desirability of substituting incandescent gas-burners in the lamps in the streets at present fitted with flat-flame burners. Having regard to the greater lighting power of the former burners, and to the fact that they are more economical than the latter, the City Engineer (Mr. J. W. Bradley) was recently instructed to ascertain upon what terms the Gaslight and Coke Company would undertake to install and maintain incandescent gas lighting. The Company submitted a scheme, under which they would replace all the existing flat-flame burners in 1259 street-lamps, by incandescent burners, for the sum of £2763—the payment by the Council being spread over a period of five years, and the Company not charging interest. The Engineer expressed the opinion that the proposal was very favourable to the Council; and the Committee were informed that, if adopted, it would effect a saving for the first five years of £62 per annum, and after that period of £615 per annum. Under these circumstances, they had decided in favour of the Company's offer being accepted. The matter came before the Council next day, when the Committee's report was unanimously adopted, and the Town Clerk was authorized to affix the Council's seal to the agreement to be entered into with the Company.

SOUTHPORT CORPORATION GAS UNDERTAKING.

Appointment of Mr. Bond as Engineer.

At a Special Meeting of the Southport Town Council last Tuesday, the Mayor (Mr. F. W. Brown) moved that the resignation of Mr. John Booth, the Gas Engineer, be accepted as from the 1st of May next, or some other date to be fixed by the Chairman and Vice-Chairman of the Gas Committee; and that Mr. John Bond, Assistant Gas Manager to the Leeds Corporation, be appointed to succeed Mr. Booth, at an annual salary of £550, with house, including rates, gas, coal, and water free. The Chairman of the Committee (Mr. E. Trounson), in seconding the motion, said they had had to go through 58 applications for the position of Gas Engineer, and he believed they had obtained the man who was best adapted in every respect for the management of their works. He looked forward with great confidence to the result of Mr. Bond's coming to Southport. Mr. J. Hatch, as an old member of the Council, expressed great regret that they had to part with Mr. Booth, who for 25 years had faithfully served the Council and the ratepayers. With regard to the new Manager, he (Mr. Hatch) happened to know that they had selected one of the best men in the country; and he hoped that they would give him a free hand, and that he would do his best in the interests of the ratepayers, so that the gas-works might yield the income which he had always said they ought to produce—viz., 15 per cent. Mr. C. E. Austin also pleaded for a free hand for Mr. Bond, and then he felt sure they would be satisfied with the result of his operations. The resolution having been unanimously carried, Mr. Bond was called into the Council Chamber and congratulated upon his appointment by the Mayor, who expressed the hope that his connection with the Southport Corporation would be a long and happy one. Mr. Bond, in reply, said he would do all he could for the Gas Committee and the public generally; and he trusted he should give them no cause to regret their choice.

Extensions at the Gas-Works.

In the afternoon, an official visit was paid to the gas-works by the Mayor and Corporation. Mr. Trounson explained that they had assembled in connection with fixing two new steam-boilers, the removal of the carburetted water-gas plant to another site, and the erection of an additional section of this plant. The two steam boilers had been placed in the old retort-house, and other work would be undertaken. In the removal of the two sections of carburetted water-gas plant, they had had the gas-making capacity increased and brought up to date by the introduction of the latest improvements. The capacity of the original plant was equal to a make of 750,000 cubic feet of gas per day. This has now been increased to 1,100,000 cubic feet; the plant being equal to the production of 1,650,000 cubic feet daily. The horizontal steam engines had been replaced by turbines, of which there are two, specially designed for driving the blowing plant. The total capacity of the manufacturing plant at the gas works at Crowlands is now 3,270,000 cubic feet per day. An inspection of the works was then made; and the water-gas plant was shown in operation. The new machinery mentioned by Mr. Trounson was favourably commented upon by Mr. Booth. Mr. Walmsley (Assistant Engineer) conducted the party, which included Mr. Bond, the new Engineer and Manager.

A LECTURE ON "BAD GAS AND HOW TO IMPROVE IT."

By Mr. W. R. Herring.

On Thursday, the 18th ult., Mr. W. R. Herring, M.Inst.C.E., the Chief Engineer and Manager of the Edinburgh and Leith Gas Commissioners, delivered a lecture on the above subject to the Building Trades Exchange of the City and District of Edinburgh, Limited. He explained at the outset that the quality of the gas supplied to the city had been much discussed at various ward meetings; and therefore he had yielded to a request to come and say something about gas. He then proceeded with his lecture, from which we make the following abstracts.

The object of my coming before you to-night is to demonstrate to you that there is no such thing as bad gas—quality depends wholly and solely upon the method of using it; and I think before we part this

evening we shall be convinced that it is so. Before proceeding with any of the demonstrations, however, I had better explain what is meant by 25-candle gas. You hear people question the accuracy of our statements, and they will often call one's attention—my attention has often been so called—to the little flickers that are to be seen in our side streets. They say: "Do you call that 25-candle gas?" "Certainly not;" that, of course, is not 25-candle gas. The public lighting by gas in Edinburgh is strictly limited to a consumption of 2 cubic feet per burner per hour; and the illuminating power, at its best, is about 5 candles, in consequence of the burner that has to be employed in our draughty lanterns being unsuitable to generate the highest efficiency from the gas consumed. The initial illuminating power of a gas—that is, the quality of the gas made at the works—is of no practical importance, so far as the lighting effect is concerned. Of course, it has its economic considerations. What I mean to say is that, even with 15-candle gas, you can get perfect lighting. In proof of this, the illuminating power on the Continent is 10 to 12 candles. In London, on the south side of the river, it is 14 candles, and on the north side 16 candles is the standard; while in the South of England it is 14 to 15 candles, and in the Midland counties it ranges from 16 to 18 candles. In the North of England it is 18 to 20 candles; and in Scotland we have 25 candles. Now, those of you who have visited the Continent will know that the shop lighting by the flat-flame burner is as unsatisfactory as it is in some Scottish towns. It is the quantity of gas burnt and the class of burner used that give the light. [Mr. Herring demonstrated the effect of using good and bad burners. He took four and showed that all of them were not suited to yield anything like satisfactory results from the gas consumed.]

My next point is to demonstrate to you the effect of bad burners; and in this instance I will show you some which have been quite recently removed from the houses where people have complained of bad gas. [Various burners were shown in operation.] The first was removed from the house of a prominent member of the Edinburgh Corporation who complained from his seat in the Council Chamber about the bad gas. That, I may say, was the first time we had heard of the complaint; and immediately on hearing it we despatched one of our inspectors to make an investigation and report. This is one of the burners removed, taken indiscriminately from among others. It consists of a No. 4 Bray burner, passing 3·65 cubic feet of gas, giving an illumination of 4·46 candles. To demonstrate to you that the lighting effect depends wholly and solely upon whether or not the burner is suited to the gas, I have here a simple cap, which is exactly like an ordinary burner, and which, when slipped over the old burner, has the same effect as putting on a new one. I do this in order to demonstrate to you the effect of a good and a bad burner. I will leave the gas-tap just as it now is, and the flame burning; but immediately upon my covering the old burner with the cap, you will notice the difference in the amount of light from the same consumption. Compare this light with what it was before. We have increased the light from 4·46 candles to 16·44 candles, or 275 per cent. [Similar effects were produced with the other burners; the increase in light being respectively 321, 457, and 524 per cent.] I do not suggest that the burners are the whole and sole cause for complaints. There are, of course, other conditions which affect the supply of gas, and inconvenience the public. But in 99 cases out of 100, the burner is alone at fault.

I would now like to deal with the globes or shades used for covering the flames, as these sometimes play a very important part in the amount of light given off by the burner. I have several globes here, and may say that I have taken a clear, colourless chimney as the standard, though it absorbs a little light. By using over an incandescent burner a clear glass pink chimney instead of a colourless glass chimney, we lose 19·3 per cent. of the light. A plain white opal globe, such as is very commonly used, absorbs 33⅓ per cent. of the light. A pale burnt straw-coloured globe, such as we recommend for incandescent lighting, where the white light is objected to, the globe etched and with a cut star, the star facing the disc, absorbs 33⅓ per cent.; the same globe with the etching facing the disc, absorbs only 20·4 per cent. In this case, you will see that though the apparent lighting effect of the star within the line of vision makes the illumination appear more brilliant, it is really an optical delusion, brought about by the brilliance on the cut face of the star yielding an intensity, but a deficient volume of light. The next is a white etched globe, with cut star; and in this case, with either the star or the etching facing the disc, the loss of light amounted to only 6·4 per cent. Then we have a white opal with large and small cut stars; the stars being cut through the opaque thickness of the globe, with a large star facing the disc. With this we lose 35·5 per cent.; this figure comparing pretty closely with the loss through using a plain white opal globe, previously referred to. We have here an exactly similar type of opal globe, but tinted a pale pink. In this case, with the large star facing the disc, we lose 25·8 per cent., and with the smaller star facing the disc, 37·6 per cent.; so that the tinting of this very pale shade of pink appears to make a difference of 4 to 5 per cent., as compared with the white opal. The last is a faintly ground glazed surface; and this obstructs only 7·5 per cent. of the light. [Before leaving the subject of lighting, Mr. Herring remarked that the dark colours used in the decoration of rooms absorb a great deal of light, and in no way assist in its diffusion or reflection.]

We now come to the more general topic of fittings. Gas-fittings have been in some houses forty or fifty years, or even longer, and in many cases have never had anything done to them. What I wish to point out is this—that very often complaints arise from local sources that have nothing to do with the gas. Here is a case. This pipe has been completely flattened by the effect of a bell swinging against it. You see the supply is almost entirely cut off. There is another instance—a ⅝-inch pipe damaged by bags of firewood being thrown against it. The pipe is almost doubled up. Here is a pipe which is almost cut through by the working of a bell-wire. Here is still another—this being from a friend of our Chairman, who was complaining about bad gas. We sent down to examine, and this is the pipe as it was cut out. In Edinburgh we find that in large houses a ⅝ inch pipe is the common size entering the house from the street. There are often from 30 to 40 burners in these houses; and to expect a ⅝-inch pipe to supply them is out of the question, In new properties, we exercise a control, and see that suitable pipes are laid in when building. This is done in the interests of the public as well as in that of the party who buys or enters the house.

Coming to the distribution of gas, I should like to put to my audience a pertinent question. I cannot understand why architects and builders continue to persist in fitting up new houses with coal-ranges. The first thing a party does when entering a new house is to make immediate application to the gas office for a cooker to be fixed; and many ask us to do the impossible, and fix a gas-cooker where there is not any room in the kitchen for such an appliance. It seems to me that to continue to put in the old coal-range is quite out of date. The type of range now required is a combination of the two. I have seen such a range; and I do not know why it should not become common in every new house. It consists, on the one half, of a gas-oven with boiling burners and hot-plate at the top; and on the other half of an open fire, with boiler for the hot water supply. I would earnestly direct your attention to this particular device; and, further, I should like architects and builders to be more generous in prescribing and providing for gas-fires in bedrooms and occasional rooms. There is no doubt that, at the present day, when the servant question has become such a difficult one, the provision of a fire heated by gas in the occasional rooms is well worthy of the attention of builders and architects.

In conclusion, I may perhaps say a few words about incandescent lighting. As a Gas Engineer, I may say that I look upon flat-flame lights as old-fashioned and behind the times. Three years ago, I walked the streets of Amsterdam in search of an ordinary burner, and did find one at last, illuminating a basement cellar where a wood chopper was at work. The reason for incandescent lighting on the Continent being so general is that the burners and mantles have been much cheaper there than in this country. We are now, however, pretty free with regard to incandescent patent rights, and burners and mantles can be purchased for a very moderate sum. The incandescent burner undoubtedly uses the gas scientifically, and secures the most perfect combustion in every respect. In an ordinary burner, consuming 5 cubic feet of gas per hour, you get 25 candles of illumination; with an incandescent burner, the same gas will give you 175 candles, or seven times as much light. Why, therefore, the old type of burning gas should still be continued by the public, is beyond the ken of one who knows the difference. There is a type of incandescent gas lighting which is well suited for workrooms, shops, &c. It is a Lucas lamp of 700-candle power; and I may tell you it is costing ½d. per hour. For large power lighting, or where a big show is desired, nothing is better than this type of lamp.

Mr. Herring answered several questions on the subject of his lecture, and was accorded a very hearty vote of thanks.

THE MARYLEBONE ELECTRIC LIGHTING QUESTION.

The Mayor of Marylebone (Rev. H. Russell Wakefield) has addressed a long letter to "The Times" on the above subject, in the course of which he gives the following as his personal views on what he considers to be the effect of the recent poll.

The poll has given the sanction of the ratepayers to the promotion of a Bill in Parliament to enable St. Marylebone to borrow the money necessary to pay for the Marylebone part of the Metropolitan Electric Supply Company's undertaking, under an award made in an arbitration by which the Borough Council and the Electric Supply Company were each of them bound. The poll has also signified the approval of the ratepayers to the borrowing of other money for purposes connected with the purchase mentioned above. That is, broadly speaking, the position, but not, in my judgment, the whole position. The poll took place after a resolution had been passed by the Committee of the Council who has charge of this matter, expressing a determination to make every effort to further negotiations with a company for the purpose of transferring the management of the electric light undertaking from the shoulders of the Council. Such negotiations were going on when the poll was taken; and I am persuaded that some appreciable number of votes went in favour of the Bill in consequence. The Council is, therefore, bound to continue its efforts in this direction. But the Bill, or a considerable portion of it, will be required to bring any such negotiations to a successful issue. It behoves all who are interested in a speedy and an economical settlement of the question to do all they can to get our measure passed. I cannot understand anyone who wishes to help Marylebone opposing the Bill altogether, though I am aware that amendments, possibly considerable ones, must be made in it. I am writing as one who still hopes confidently that some of the negotiations going on will come to a successful issue. I wonder whether the public realizes even now that the hope I express has substantial foundation. Leaving on one side for the moment both the contention of the majority of the Council, that the undertaking if managed by the Municipality would be financially successful, and the offer of one Company, which in effect seems to me to mean the taking over of our responsibilities without loss to the borough, and with possible profit in time, I ask consideration for the far less favourable suggestion which proceeds from the Metropolitan Electric Supply Company itself. Briefly put, the following are its terms: The Company will take the borough's bonds (lending the money) in payment of the award, and will pay in annual rent the interest on the loan and £7000 towards the sinking fund. As this fund will be about £15,000 per annum, that leaves £8000 for us to find, or a rate of under 1½d. in the pound. In addition, the Company agrees to pay after 1912 a share of the net profit of the undertaking to the Council. It is right to add that the Company does not wish to include in the loan the law costs (about £60,000) of the arbitration. Such are the terms. I do not consider them such as we can accept; but they do afford a basis for further and, I hope, favourable suggestions on both sides. I hear absurd statements as to people being afraid to come to reside in Marylebone because the rates are going to be something quite extraordinary. The worst I can see as possible is one rate of 9d. in the pound for the legal

expenses, and 1½d. in the pound for seven years. I shall be more than surprised if this worst is ever a reality.

On behalf of the Committee of Ratepayers in Marylebone, the Hon. Herbert C. Gibbs has addressed a letter to the President of the Local Government Board, drawing his attention to the salient facts of the electric light question, in the hope that a measure may be introduced into Parliament "to remedy certain defects in municipal government." It is pointed out that on May 2, 1901, the Borough Council and the Metropolitan Electric Supply Company signed a contract to the effect that the Council should abandon their attempt to obtain a competing Order, and should agree to buy out the property of the Company by arbitration. This contract was embodied in a Bill which received the Royal Assent on July 26, 1901. The award of the Arbitrator was made in February, 1903, and amounted to £1,212,000. Of this sum, according to the calculation of the Council's Surveyor, about £1,000,000 represented the goodwill of a concession which had 27 years to run, and was liable to competition. The cost of obtaining this award was £60,000. Further large sums were also required to erect a generating station, as this item was not included in the award; and, in addition, the Company were authorized to change their system from high to low tension for the Council. On Dec. 11 last, Mr. Justice Buckley ordered the Council to pay £60,000 on account of this expenditure. Thus, in all, the total sum of £1,881,000 is required to carry out their scheme. Mr. Gibbs also points out that Mr. Justice Buckley gave judgment against the Council for specific performance of their contract, and ordered the payment of the award. The Ratepayers' Committee suggest that no contracts should be made or Bills promoted in Parliament involving a charge upon future years, unless a majority of two-thirds of the electors have signified their approval. They also think that in respect of Metropolitan Boroughs, a statement for and against any proposed business of importanoe should be prepared by the majority and minority of the Council, and circulated to all the electors. They also recommend that voting-papers should be filled up by electors at their own houses, or at least that each elector should be informed of the situation of his polling-place.

The Subway System in Scotland.—The Town Council of Falkirk, in constructing a new street connecting two of the principal thoroughfares of the town, have adopted the conduit system for carrying the main water and gas pipes, as well as the electric light and telephone cables, &c. Between the conduit (which is of brick, 6 feet high and 4 feet wide), and the properties on either side, branch conduits have been made, so as to admit of drawing in water and gas pipes and electric and telephone wires to the new properties. As far as we are aware, Falkirk is the first place in Scotland to adopt the system. The works have been designed by Mr. David Ronald, the Burgh Engineer, and have been carried out under his supervision.

METROPOLITAN WATER ARBITRATION.

(*Before the Right Hon. Sir* EDWARD FRY, *Sir* HUGH OWEN, G.C.B., *and Sir* JOHN WOLFE-BARRY, K.C.B.)

Fifty-Third Day—Monday, Feb. 22.

The Claims and Awards.

As reported last week (p. 484), on the resumption of the proceedings to-day, the awards of the Court were given on the claims of the Lambeth, Southwark and Vauxhall, Chelsea, and Kent Companies. The original claims, which in most cases had been subsequently amended, were respectively as follows: Lambeth, £5,511,342; Southwark and Vauxhall, £5,674,140; Chelsea, £4,750,000; and Kent, £3,715,514. The offers by the Board were: Lambeth, £1,000,000; Chelsea, £1,750,000; and Kent, £1,500,000. No offer was made in the case of the Southwark and Vauxhall Company. The Arbitrators' awards were: Lambeth, £4,301,000 if liable to the Chamberlain's sinking fund, or £4,589,000 if not; Southwark and Vauxhall, £3,603,000 or £3,926,000, under like conditions; Chelsea, £3,305,000 or £3,418,000, according to the correctness or otherwise of the ruling as to the dividends; and Kent, £2,712,000. The award in the Chelsea case was subsequently amended by the addition of £700, owing to a miscalculation in regard to the dividends. The award in the Kent case included future costs.

The Claims Against Richmond and Croydon.

The Court then proceeded with the claims of the Water Board against the Corporations of Richmond and Croydon.

The Hon. J. D. FITZGERALD mentioned that there was a strong possibility that an agreement would be arrived at between the parties in the Richmond case; and he applied that this should be adjourned.

Mr. L. COWARD, who, with Mr. ROBERTSON, appeared for the Corporation, agreed; and the case was adjourned *sine die*.

The claim made by the Board against the Croydon Corporation was then heard.

The Hon. J. D. FITZGERALD stated that though the Corporation had their own water-works, part of the borough had been supplied by the Lambeth Company. The mains, service pipes, &c., which would be transferred to the Corporation had been valued at £35,000. In addition, the Board were entitled to make a claim in respect of any loss of the right of supply, which was arrived at by capitalizing the net water-rental at £225,800; and the Board also asked to be repaid expenses, amounting to £10,000.

Evidence was then given in support of the case of the Board by Sir *A. Binnie*, Mr. *D. Young*, and Mr. *P. Bevan*.

Mr. RAM, who, with Mr. COLAM, appeared for the Corporation, said it was estimated that the supply given by the Lambeth Company was 500 million gallons; and they offered to pay the Board £190,000.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 526.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	19 - 20	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	Nov. 12	6½	Bombay, Ltd.	5½ - 6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Feb. 25	12	Brentford Consolidated	222—227*	..	5 5 9
300,000	,,	,,	9	Do. New	167—172*	+½	5 4 8
50,000	,,	,,	5	Do. 5 p.c. Pref.	127—132*	−½	3 15 9
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	103—108	..	3 14 1
220,000	Stk.	Sept. 11	10½	Brighton & Hove Orig.	207—212	..	5 1 5
246,320	,,	,,	7½	Do. A. Ord. Stk.	145—150	..	5 3 4
460,000	20	Oct. 15	10	British	37½—38½	..	5 3 11
100,000	Stk.	Feb. 25	6	Bromley, Ord. 5 p.c.	112—117*	..	5 2 7
165,700	,,	,,	4½	Do. do. 3½ p.c.	85—90*	−½	5 0 0
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd	10½—11	..	6 7 3
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
150,000	20	July 10	8½	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.	14—15	..	6 13 4
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Feb. 25	5⅛	Commercial 4 p.c. Stk.	102—107*	+1½	4 17 3
556,485	,,	,,	5	Do. 3½ p.c. do.	97—102*	+½	5 0 0
442,947	,,	Dec. 11	3	Do. 3 p.c. Deb. do.	84—87	..	3 9 0
800,000	Stk.	Dec. 30	7	Continental Union, Ltd.	110—115	..	6 1 9
200,000	,,	,,	7	Do. 7 p.c. Pref.	130—135	..	5 3 8
575,000	Stk.	Feb. 25	5⅛	Crystal Palace Ord. 5 p.c.	108—113*	+½	4 14 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	115—120*	−½	4 3 4
112,533	,,	Jan. 14	5	Do. 5 p.c. Deb. Stk.	134—137	..	3 13 10
486,090	10	Jan. 28	10½	European, Ltd.	18—19	..	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Feb. 11	4 5/16	Gas-light and Coke ⎫ 4 p.c. Ord.	86—88	..	5 0 0
2,600,000	,,	,,	3½	⎭ 3½ p.c. max.	87—89	..	3 18 8
3,799,735	,,	,,	4	⎫ 4 p.c. Con. Pref.	104—108	..	3 14 1
4,193,975	,,	Dec. 11	3	⎭ 3 p.c. Con. Deb.	85—87	..	3 9 0
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	16—17	..	6 9 5
3,800,000	Stk.	Nov. 12	10	Imperial Continental	193—196	..	5 2 0
473,600	Stk.	Feb. 11	3½	Do. 3½ p.c. Deb. Red.	97—99	..	3 10 8
165,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	105—110	..	5 9 1
561,000	Stk.	Feb. 25	10	Liverpool United A	209—211*	..	4 14 9
718,100	,,	,,	7	Do. do. B	158½—160½*	..	4 7 3
306,083	,,	Dec. 30	4	Do. do. Deb. Stk.	108—110	..	3 12 9
75,000	5	Dec. 11	5	Malta & Medn., Ltd.	4½—4⅝	..	5 5 3
560,000	100	Oct. 1	5	Met. of ⎫ 5 p.c. Deb.	101—105	..	4 15 3
250,000	100	,,	4½	Melbourne ⎭ 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 12	3½	Monte Video, Ltd.	9—10	..	7 0 0
1,515,892	Stk.	Feb. 26	4½	Newc'tle & G'tesh'd Con.	106—108*	+½	4 3 4
405,025	Sdk.	Dec. 31	3½	Do. 3½ p.c. Deb.	94—95	..	3 13 8
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	135—140	..	5 14 4
600,000	5	Sept. 30	7	Ottoman, Ltd.	5—6	..	5 16 8
					Ex div. *		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	Jan. 14	6½	Ply'mth & St'house 5 p.c	121—126	..	4 17 2
851,070	10	Oct. 15	7	River Plate Ord.	11—11½	..	6 1 9
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
250,000	10	Sept. 30	8	San Paulo, Ltd.	10¼—11½	..	6 19 2
135,000	Stk.	Sept. 11	10	Sheffield A	241—243	..	4 2 4
209,984	,,	,,	10	Do. B	240—242	..	4 2 8
523,498	,,	,,	10	Do. C	239—241	..	4 3 0
116,106	Stk.	Sept. 30	5	Shrewsbury Ord. 5 p.c.	109—112	..	4 9 3
6,150,000	Stk.	Feb. 11	5½	South Met., 4 p.c. Ord.	117—119	..	4 9 6
1,832 700	,,	Jan. 14	3	Do. 3 p.c. Deb.	85—88	..	3 8 2
380,940	Stk.	Nov. 12	5	Southampton Ord.	105—110	..	4 10 11
87,950	,,	Jan. 14	4	Do. 4 p.c. Deb.	103—103	..	3 17 8
120,000	Stk.	Feb. 25	6	Tottenham and Edmonton ⎫ A. 5 p.c.	112—117*	..	5 2 7
313,020	,,	,,	4½	⎭ B. 3½ p.c.	93—98*	+½	4 11 10
182,380	10	Dec. 30	8	Tuscan, Ltd.	8—9	..	8 17 10
149,000	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	97—99	..	5 1 0
745,872	Stk.	Aug. 13	5	West Ham, 5 p.c. Ord.	96 99	..	5 1 0
				WATER COMPANIES.			
781,517	Stk.	Dec. 30	12	Chelsea, Ord.	350—355	+30	3 7 7
150,000	,,	,,	5	Do. 5 p.c. Pref.	142—147	..	3 8 0
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	132—137	..	3 5 8
175,785	,,	Sept. 30	4½	Do. 4½ p.c. Deb.	132—137	..	3 5 8
1,720,560	Stk.	Oct. 15	8	East London, Ord.	220—225	..	3 11 1
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb.	133—138	..	3 5 3
1,252,943	,,	,,	3	Do. 3 p.c. Deb.	87—90	..	3 6 8
700,000	50	Dec. 11	10	Grand Junction ⎫ 10 p.c. max.	135—138	..	3 12 6
310,000	Stk.	Sept. 30	4	⎭ 4 p.c. Deb.	115—120	..	3 6 8
708,000	Stk.	Feb. 25	10	Kent	310—320*	+25	3 2 6
160,000	,,	,,	7	Do. New, 7 p.c. max.	210—220*	+18½	3 3 7
1,043,800	100	Dec. 30	11	Lambeth, 10 p.c. max.	310—320	+20	3 8 9
406,200	100	,,	8½	Do. 7½ p.c. max.	220—230	+5	3 13 11
350,000	Stk.	Sept. 30	4	Do. 4 p.c. Deb.	115—120	..	3 6 8
500,000	100	Feb. 25	10	New River, New Shares	—	..	—
1,000,000	Stk.	Jan. 28	4	Do. 4 p.c. Deb.	116—119	..	3 7 3
902,300	Stk.	Dec. 30	7½	South-wark and Vauxhall ⎫ Ord.	270—280	+5	2 13 7
126,500	100	,,	7½	⎭ 7½ p.c. max.	215—225	−5	3 6 8
489,200	Stk.	,,	5	⎫ 5 p.c. Pref.	142—147	..	3 8 0
1,019,585	,,	Oct. 15	4	⎭ 4 p.c. A Deb.	115—120	..	3 6 8
1,155,066	Stk.	Dec. 11	10	West Middlesex	290—295	..	3 7 9
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb.	88—91	..	3 5 11
					* Ex div.		

Mr. *G. R. Strachan* and Mr. *H. Rote* gave evidence.

The inquiry occupied the Court all the next day (Tuesday), when the further proceedings were adjourned till Friday.

Fifty-Fourth Day—Friday, Feb. 26.
Award in the Claim against Croydon.

To-day the award was given in the claim of the Board for £225,810, in respect of water-works transferred by the Lambeth Company to the Corporation of Croydon, and loss of right of supply. The Court decided that the Corporation should pay to the Board £225,810; the transfer from the Board to the Corporation of the water-works and plant to take place on June 24, or other appointed day under the Act. The Board are to supply the Corporation in perpetuity with not exceeding 500 million gallons of water in any year; but the Corporation shall not be entitled to demand more than 52 million gallons in any consecutive 31 days. During a term of thirty years, the Corporation are to pay the Board 2¼d. per 1000 gallons of water supplied—the quantity per year to be 400 million gallons. At the expiration of thirty years, and of every successive period of ten years, the price and terms are to be subject to revision. Each party bears its costs of the arbitration and award.

Mr. FITZGERALD, for the Water Board, said that, in fixing the price, interest and allowance in respect of capital had been rightly excluded; and there was no claim made for it. But when they were dealing, as the Arbitrators were dealing here, with a state of circumstances which might exist thirty or forty years hence, or even a longer period, conditions might arise under which it would be reasonable to take the question into consideration. He suggested that the clause referred to should be altered to read "in respect of existing capital."

Mr. RAM, on behalf of the Corporation, objected to the proposed alteration.

The Court, after considering the proposal in private, decided to adhere to the existing draft.

The Court then adjourned *sine die*.

It was stated that judgment in the claim of the New River Company, which awaits decision on certain legal points by the Court of Appeal, is to be delivered to-morrow (Wednesday).

America has just been visited with another destructive fire—this time in the city of Rochester, in the State of New York. It started in the Dry Goods Company's building, and was caused, it is reported, by a defect in the connections of an electric motor in the basement. The flames quickly spread to the elevator shaft, and in a short time the building was destroyed. The fire attacked adjoining property, and eventually a large portion of the business section of the city was in ruins. The damage is estimated at from $5,000,000 to $7,000,000; and 2500 people have been thrown out of employment.

THE ILLUMINATING POWER OF GODALMING GAS.

The Godalming Gas Company, Limited, a few days ago appeared before the Magistrates, at the instance of the Town Council, on a summons for having failed to supply gas of an illuminating power of 14 candles, as required by section 17 of the Godalming Gas Order, 1878. Dr. Rideal said that he tested the gas on Nov. 24, with the apparatus provided by the Company, and found it to be of 10·97-candle power. He had previously tested the gas on Jan. 6, 1903, when it was of 13·59-candle power, and on June 26, when the result was 14·3 candles. Cross-examined by Mr. W. L. Williams, witness said he had no doubt as to the accuracy of the figures on which the summons was taken out. He only took one test of ten observations. He knew that in London the Referees required three sets of tests; and that if these showed a less illuminating power than the Act prescribed, a fourth had to be made. Had he, however, taken three tests at Godalming, it would not have been a legal test. On June 27, at the request of the Manager (Mr. B. Bark), he made a second test; and he might have remarked on that occasion, that there must be something wrong. Mr. Bark asked him to make another test, and he refused. Mr. Williams asked if the jet photometer gave a fair idea of what the illuminating power might be; and witness answered: "Within 5 candles." He explained that it was designed for coal gas, and that within the last few years there had been an entire change owing to the mixture of water gas. Asked if Mr. Bark showed him that the jet photometer indicated something like 16-candle power, witness replied that he had no faith in the photometer. At this point, the Magistrates held a short consultation, as the result of which the Chairman (Mr. J. E. Sparkes) announced that they had unanimously decided that one test was unsatisfactory. The case was therefore dismissed; but no order was made as to costs.

REGULATION OF GAS SUPPLY IN NEW YORK.

Testing of Gas, Meters, and Fittings.

We learn from the "American Gaslight Journal" that a Bill is now before the State Legislature and will in due course be considered by the Lower House and the Senate, for regulating the trade in gas in New York City.

The Bill consists of two amendments to the Charter of the City. The first alters section 519, which deals with the powers of the Commissioner of Water Supply, Gas, and Electricity. It extends the supervision now exercised by him over electricity-meters so as to include gas-meters. Under its term, the Commissioner is to cause tests to be made of all meters in use in the city for measuring the quantity of gas, as well as electricity or steam, furnished by any corporation or person. It provides that no corporation or person shall furnish or put in use any gas, electric, or steam meter which shall not have been inspected, approved,

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and sealed by inspectors appointed by the Commissioner. Gas companies must keep on their premises proper apparatus for testing and proving the accuracy of meters furnished by them for use. Whenever a meter has been inspected, the inspector is to attach thereto a seal or stamp with his name, the date of the inspection, and a statement as to whether or not the meter is accurate. The Commissioner is to cause every gas-meter in use or intended to be used to be tested at least once in every year, and an accurate and detailed report of its condition is to be kept as part of the records of the department. Whenever a meter is found defective, he is to order it to be removed and replaced by one which has been tested and approved. Meters in use are to be re-inspected and tested on the written request of the consumer or of the company, in the presence of the consumer if desired. If the meter is found defective to the prejudice or injury of the consumer, the removal, inspection, and replacing of the meter shall be done without expense to the consumer; but in all other cases, except where the change is beneficial to the company, he shall pay the reasonable expense of the inspection.

An amendment to this section permits the inspectors of the Department of Water Supply, Gas, and Electrity at all reasonable times, on exhibiting written authority from the Commissioner, to enter any dwelling, store, or building lighted with gas for the purpose of inspecting the meter, pipes, fittings, and works, and the quality of the gas supplied; and any person who hinders such inspector is to be guilty of a misdemeanour. The Commissioner may adopt such rules and regulations, and may direct and compel the use of such meter or other mechanical device, as in his judgment may be necessary for the purpose of recording the quantity of gas consumed and controlling and regulating the pressure of gas or other substance into the pipes or other apparatus used in the distribution of gas. It will be the duty of every person or corporation supplying gas to consumers to comply with these rules; and failure to do so is made a misdemeanour.

The second section of the Bill amends section 522 of the Charter, under which the Commissioner now tests the quality of gas. It strikes out the restriction that he may not inspect the gas oftener than once a week, and permits him to make tests as frequently as may be necessary. It eliminates also the requirement that three consecutive tests must show an illuminating power less than the standard before a fine may be imposed, and makes it the duty of the Commissioner to impose a fine whenever such a test shows that the gas is below the standard. The amount of the fine is raised from $100 as at present to $500. It is provided that an accurate record of all the tests shall be filed with the Department of Water Supply, Gas, and Electricity.

As an auxiliary to this Bill, the Corporation Counsel (Mr. Delaney) has drawn an amendment to Article VI. of the Transportation Corporations law, by which all the powers now exercised by the State Inspector of Gas-Meters are conveyed to the Commissioner of Water Supply, Gas, and Electricity in the City of New York. Hope has been expressed by the Mayor that the Bill will be supported by the Democratic members and find favour with a majority of the Legislature.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The lecture by Mr. W. R. Herring, of Edinburgh, to the Building Trades Exchange, of which a summary is given in another column, is one of those things which, though uncommon, are not common. The subject is a very common one, and is being constantly dinned by gas managers into ears which, unfortunately, are too often unwilling to hear; but it is not often that it is made a set subject of a formal address to men engaged in business, as was done here. Mr. Herring went into the arena to do battle with technical ignorance, which is universal; and his tale, plain and unvarnished though it be, must have filled the listeners with respect for an industry which it has been the fashion of late years to neglect, if not to frown upon. It is well that the attention of work-a-day people should be recalled to the fact that, in the lighting of human habitations, there is a waste going on which need not be, if intelligence be applied to the subject, and another standard is taken than that of the most costly method of artificial lighting. To withdraw the intellect of the industrial world from the glamour of that which has not for its chief recommendation its actual accomplishment, but the amazing bulk of its expectant possibility, is the duty of everyone who is in the hive, and who recognizes that, if honey is to be made, it will not be by looking wistfully to summers yet to come, but by diligent application to the means at present in our hands. That Mr. Herring's address did this will be admitted by all who read it; and we must cherish the belief that such well-directed effort cannot be fruitless.

A gentleman having written to Mr. Herring that it was desirable to have cheaper gas for cooking and heating purposes, has received the following reply, which he has published: "I may say I have had some experience of this practice in other towns in England; and, from an economical point of view, have found it necessary to condemn such a practice. Gas-works and electricity works are diametrically opposite, so far as the essential features of manufacture are concerned. A gas-works endeavours to produce a uniform quantity of gas every hour, day and night—that is to say, during the lighting hours, from lighting-up time to about eleven or twelve o'clock at night, the manufacture of gas is considerably less than is required for consumption; the gas-holders or the storage accommodation supplying the additional quantity required. There are other periods of the night and day when the gas manufactured is considerably in excess of what is required for consumption; the overplus, however, automatically feeds into the gas-holders, and is there ready for the increased demand during the lighting hours. But in the case of electricity works, the whole of their machinery and equipment must be equal to the maximum demand during any five minutes of the twenty-four hours—that is to say, they have no means of storing their electrical current. It therefore follows that they have a very large amount of plant standing idle during the

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greater part of the twenty-four hours. They can, therefore, afford to supply electrical current at a very much reduced cost for such appliances as you name, particularly in view of the fact that such an enormous consumption has to be indulged in in order to get a very small amount of heat." The gentleman to whom this was written did not adopt the argument. To him there is no reason which appeals, except this—that electricity is supplied at a cheaper rate for cooking and heating; therefore so should gas.

The Corporation of Broughty Ferry on Monday last considered the report of their Engineer and Manager—Mr. G. Keillor, jun.—upon the condition of the gas-works, and the suggestions upon the report which had been received from Mr. W. R. Herring, of Edinburgh. Mr. Keillor's report was based upon the assertion that the works "are much too small for the economical utilization of coal and coke conveying and stoking machinery, more especially when the adopted installation is incomplete and imperfectly put together." It had, he said, been suggested that it would be well to abandon the present retort-house and method of carbonization by machinery, and go back to hand charging entirely. He agreed that this system should never have been departed from; but he could not advise them to abandon the method now in vogue, for obvious reasons. He therefore recommended the retention of mechanical stoking, the extension of the retort-bench by the erection of four additional ovens (32 retorts), and other extensions, at an estimated cost of £3995. Mr. Herring reported that he was of opinion that the Manager had dealt very thoroughly and quite properly with the present state of affairs. He fully concurred with his report. The expediency, however, of proceeding with the whole of his suggestions might be profitably considered. He was of opinion that some of the work might be delayed for the present season. Having gone over Mr. Keillor's report in detail, he proceeded to say that what it was proposed to carry out would be of a most profitable character with regard to the economical working of the concern, and was, in his opinion, quite sufficient to absorb Mr. Keillor's attention during the present season. After it was completed, and they had had another winter's experience, both as regarded the conditions of manufacture at the works and also the probable development and extension of the gas supply, they would then be in a better position to determine whether the other portions of the scheme should be proceeded with in the following season. Under any circumstances, he might say that the scheme proposed by Mr. Keillor was an excellent one, and the best that could be devised to make the works as efficient in their arrangements as the structural conditions would permit. Mr. Keillor thereafter submitted a report in terms of the recommendations of Mr. Herring, in which he brought out an estimated expenditure of £2530. Mr. Chrystal, the Convener of the Gas Committee, moved that the Council adopt the amended scheme, at an outlay not to exceed £2530, and that the whole cost be placed to a suspense account, to be wiped off in a period not exceeding ten years. He said he quite realized that necessity alone could justify any expenditure upon the gas-works in the present circumstances. Mr. Sim moved that the proposed works be not yet proceeded with. Other experts besides Mr. Herring had, he said, made recommendations with reference to the gas-works, which were not carried out; and he thought that when the Manager had been able to get along with the present works and appliances, he could surely do more next winter, when he would have the works better arranged and in better condition. Mr. Sim's motion was not seconded; and, consequently, it was resolved to proceed with the amended scheme. The works to be undertaken include the extension of the retort-bench, alterations to the coal breaker, conveyor, and hopper, additional overflow tar-valves, a new condensing main, repairing mouthpieces, the provision of a narrow-gauge railway for coke conveying, a cast-iron water and ammoniacal liquor overhead tank, and alterations upon the sulphate plant. The works to be deferred are the provision of new washing and scrubbing apparatus, and a new station-meter. It will be seen from this that there is a good deal of work to be done. Mr. Keillor's report was a most exhaustive and able one, and, had it not been for financial difficulties, no doubt it would have been adopted in its entirety.

The Gas-Works Committee of the Perth Town Council on Monday resolved to ask the Council to apply, in their new Provisional Order, for £15,000 for gas-works purposes. Treasurer Lawrie intimated that, when the recommendation comes before the Town Council, he will be able to prove that the Gas Committee do not require any additional borrowing powers.

In the promotion of their electric lighting installation, the Corporation of Hamilton have, under a Provisional Order obtained in 1901, power to assign the gas rates and charges as security. This provision, however, is not sufficient to induce lenders of money to come forward, and, consequently, the Corporation are promoting a fresh Provisional Order, in which they ask powers to give the burgh rates in security. The Town Council on Monday agreed to this being done. Provost Keith intimated that it was not intended to charge the Gas Committee with the costs of the Order, and that they could have got £10,000 of trust funds a few months ago if they had been able to give the burgh rates as security. They had, however, already received upwards of £5000 from lenders, in sums of under £10—a result which he considered was most satisfactory.

The Richmond Gas Stove and Meter Company.—The report of this Company for the year ending Dec. 31 states that the balance standing to the credit of the profit and loss account, after deducting debenture interest and the Managing-Directors' commissions, and including the amount brought forward from last year, is £27,754 11s. 2d. The payment of the 6 per cent. dividend on the preference shares will absorb £5738; and one at the rate of 10 per cent (free of income-tax) on the ordinary shares, £7911. A sum of £4099 is to be written off for depreciation, and £4442 is to be placed to the credit of the general reserve fund and £500 to that of the branch reserve fund. This will leave an amount of £5064 to be carried forward, subject to a vote for Directors' remuneration.

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W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract), 1,800,000 C. Ft. HAMILTON, ONT., 400,000 C. Ft.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 27.

Sulphate of Ammonia.

Though there has been more buying during the week, prices are again a shade easier, available supplies continuing to be abundant. The closing quotations are consequently £12 10s. per ton f.o.b. Hull, and £12 12s. 6d. per ton f.o.b. Liverpool and Leith. The situation has been occasioned by the continued abstention of Continental buyers; their Home production being available at prices below the equivalents of those current at United Kingdom ports. Spanish and Colonial demand, though well sustained, has not been sufficient to absorb production. Home demand has scarcely made itself felt as yet, owing to unfavourable weather. In the forward position, interest is still wanting; buyers' ideas for spring months being scarcely above the level of spot prices.

Nitrate of Soda.

This is very firm, and spot prices are 10s. to 10s. 3d. per cwt., according to quality.

LONDON, *Feb.* 27.

Tar Products.

Business has been rather quiet during the past week, except for carbolic acid, the market for which has been in a very excited state. The position of pitch remains practically unchanged; but rather lower prices are quoted by dealers for forward delivery. Business is reported in South Wales over the last six months of the current year to a fairly considerable extent; but the prices mentioned are certainly under those at present ruling. There has been a fairly steady inquiry from Belgium during the past week; but consumers' ideas of value are under those of makers here, although dealers have certainly reduced their quotation for forward delivery. Consumers, however, at present hold off the market, believing in a still further fall in value. In benzol, the market is considerably easier for 90 per cent. Buyers will not pay more than 10d. per gallon f.o.b. London; and even at this price the demand is very limited. In 50-90 per cent., there is no business whatever doing, and consumers do not at present appear to take any interest in same. There is absolutely no inquiry for solvent naphtha and toluol. Prices are therefore purely nominal. The market in creosote is decidedly easier, especially in the North, where there is more offering for prompt delivery. The demand for export is not quite so good in London as was the case some little while ago; and values may be taken at a little under those recently ruling. The only business doing in anthracene is in small parcels of special quality for prompt delivery; but these are being sold at low prices. As regards forward delivery, there is absolutely no inquiry at the moment; consumers being quite indifferent as to position of same. The excitement in carbolic still continues, and business is reported at varying prices. 60 per cent. crude has been freely sold at 1s. 9½d.; and it is stated that 1s. 10½d. has been paid for early shipment f.o.b. London. Most makers, however, decline to offer at present, believing in still higher prices should the war continue. In crystals, the German makers are certainly the cheapest sellers at present. They are reported to be offering at 6¼d. to 6⅝d.; while English makers as a rule ask 7d., and business is reported to have been done at this figure by London makers, who have now raised their quotation to 7¼d.

The average values during the week were: Tar, 20s. to 23s. Pitch, London, 34s. to 34s. 6d.; east coast, 32s. to 33s.; west coast, 31s. 6d. to 32s. Benzol, 90 per cent., 10d. to 10¼d.; 50-90 per cent., 7d. to 7¼d. Toluol, 7d. to 7¼d. Crude naphtha, 3d. to 3¼d.; solvent naphtha, 8d. to 9d.; heavy naphtha, 10½d. to 11d. Creosote, London, 1⅝d. to 1 1/16d.; North, 1⅛d. to 1½d. Heavy oils, 2¼d. to 2⅝d. Carbolic acid, 60 per cent., 1s. 9½d. to 1s. 10½d. Refined naphthalene, £5 10s. to £7 10s; salts, 22s. 6d. to 24s. Anthracene, "A" quality, 1⅝d. to 2d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market is very quiet; and there is practically no business doing for either prompt or forward delivery. Beckton still quote £12 17s. 6d. for prompt, but would probably entertain business at a little under this figure. For April-June, they ask £12 15s., but are not anxious to sell forward. The South Metropolitan are reported to have declined £12 15s. for prompt, and are not offering for forward delivery. There is no business to report at Hull. Buyers will not pay more than £12 10s. for really good makes; and makers as a rule ask £12 11s. 3d. to £12 12s. 6d. for April shipment. In Leith, business is reported at £12 13s. 9d. for prompt, but £12 12s. 6d. may be taken as the market quotation for ordinary makes for prompt shipment; while it is difficult to name a price for forward delivery, as there are practically no inquiries for same. A little business has been done in Liverpool at £12 10s. to £12s. 11s. 3d., but only to a limited extent.

Messrs. F. C. Sugden and Co., of Leeds, have received repeat orders for semi-deep regenerator and generator settings from the Pontypool Gas and Water Company and the Rugeley Gas Company respectively, and an order for shallow regenerator settings from the Ballymena Urban District Council.

Extensive alterations and additions have been made to the Nelson City (New Zealand) Gas-Works by Mr. John Henderson, the Engineer to the Council. The additions include Hislop's patent regenerator retort-settings, exhauster, washer, and four purifiers of the luteless type with Weck centre-valve; and the works have been brought up by Mr. Henderson to the maximum requirements of the district. The whole of the ironwork and retort-settings have been supplied by Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees; and the erection has been carried out under the personal supervision and direction of Mr. Henderson.

THE
MAXIM PATENT CARBURETTOR
FOR ENRICHING GAS IN BULK.
PREVENTS NAPHTHALENE DEPOSITS.
OVER 120 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.
Among the Companies and Towns supplied are The Gaslight and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Oldham, Dundee, Perth, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Ten Years.
MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.
THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.
The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.
Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.
For Prices and full Particulars, apply to
THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Practically there is still no improvement to report in the general condition of the coal trade throughout this district. The demand for house-fire purposes is considerably below the average for the time of the year; and there are plentiful supplies of the better qualities of round coal on the market, with here and there special lots pushed for sale at low figures. At the pit mouth, the better qualities of Wigan Arley coals range from about 13s. and 13s. 6d. to 14s. per ton, second qualities of Arley about 11s. to 11s. 6d., good Pemberton four-feet coals from 11s. 6d. to 12s., and common round coals suitable for house-fire purposes can be bought at from 9s. 9d. to 10s. and 10s. 6d. In the lower descriptions of round coal, business remains extremely quiet. The position with regard to common round coal tends in the direction of lower prices, and, as reported last week, there is no disposition to contract forward on the part of large users, who go on buying simply from hand to mouth, and pick up cheap parcels where they can. The better qualities of engine fuel, so far as Lancashire is concerned, are moving off fairly well, and are about steady at late rates, averaging 6s. to 6s. 6d. at the pit. Inferior sorts of slack have become more of a drug, if anything; and not only are they hanging at collieries in Lancashire, but there are large surplus supplies in other districts, which are pushed on the market at very low figures. Prices in Lancashire range from 4s. to 4s. 6d. per ton at the pit for common, up to 5s. to 5s. 6d. for medium, with common slack in outside districts to be bought at from 2s. to 2s. 6d. The shipping demand remains indifferent; and steam coals delivered at the ports on the Mersey can be bought at from 9s. to 9s. 6d. per ton.

Northern Coal Trade.

Trade has been dull of late, and some of the collieries have had insufficient work; so that short time has been needful, more especially with the steam-coal pits. The want of the Baltic demand seems to be the most felt at the time when the winter requirement for fuel is passing away. Best Northumbrian steam coals are still quoted at 9s. per ton f.o.b., second-class steams are 8s., and steam smalls about 3s. 6d. These are prices for prompt delivery; for delivery over the shipping season, slightly higher quotations are generally made. In the gas coal trade, the demand is fair, though below its fullest. The range of prices is now from 7s. 10½d. to 8s. 6d. per ton f.o.b., according to quality and period over which delivery is extended. One or two small contracts for Continental gas-works have been made, at prices that, with the current freights, may leave from 8s. to 8s. 6d. per ton f.o.b. for good Durham gas coals. Other contracts are impending; but they are not of very large amount. Gas coke is now in a little smaller supply; and the price that is quoted on Newcastle Exchange is from 13s. 6d. to 14s. 3d. per ton f.o.b. for good qualities.

Scotch Coal Trade.

There is no perceptible change in trade, but, if anything, prices are easier, and the tendency seems to be still downward. The quotations are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 3d. to 9s., and splint 9s. to 9s. 3d. The shipments for the week amounted to 180,682 tons—an increase of 17,634 tons over the preceding week, and of 1726 tons over the corresponding week of last year. For the year to date, the total shipments have been 1,224,272 tons—a decrease of 89,896 tons upon the same period of last year.

Sales of Shares.—At the Queen's Hotel, Sunderland, on Thursday, Mr. Atkinson Gibson sold £10,000 of additional ordinary stock (5 per cent.) of the Sunderland and South Shields Water Company, at prices ranging from £123 to £124 10s. per £100 of stock. The total amount realized was £12,290 10s.

New Purifiers and Jager Grids for the Rochester Gas-Works.—Our article of the 16th inst., upon the "Jäger Patent Purifier Grids," has, we understand, aroused considerable interest regarding this system, which has found much favour in Continental gas circles. We learn that the Rochester Gas Company have decided to put down four new Jäger fitted purifiers at their Gillingham station, and have placed the order for them with Messrs. Samuel Cutler and Sons, of Millwall.

Penzance Water-Works.—Next Monday a paper will be read before the Society of Engineers by Mr. Frank Lattam, entitled "Some Recent Works of Water Supply at Penzance." The author will deal with the source of water supply and works previous to 1899, and the difficulties in the way of extension. He will also refer to the Hennebique ferro-concrete system as adapted to reservoir construction, to concrete gauging, and to means adopted for detecting and preventing waste of water.

The Recent Fire in Baltimore.—We learn from the "American Gaslight Journal" that the undertakings connected with the gas industry in Baltimore suffered less than might have been expected from the effects of the terrible conflagration which recently destroyed so much of the city. The Consolidated Gas Company's offices were destroyed, and great damage was, of course, done to their distributing system—thousands of meters and miles of mains and services being rendered useless. But the plant is intact, and a fortnight ago a fairly good supply of gas was being maintained in certain sections of the city. The day after the flames were stayed, the Company opened business offices, and the Manager (Mr. Alten S. Miller) and his men set to work with a will to repair damages. The shops of the Maryland Meter Company, although perilously close to danger, were saved; but the local or main office was destroyed. The Baltimore Retort and Fire Brick Company also came out scatheless; as did the main properties of the manufacturing firm of Messrs. Bartlett, Hayward, and Co., although their offices went with the flames.

THE ABOVE REPRESENTS THE SIZE OF OUR BUSINESS WHEN THE "POSITIVE" SLOT METER WAS FIRST MADE IN 1889

SAWER & PURVES,
MANCHESTER
AND
NOTTINGHAM.

IT HAS INCREASED IN RATIO TO THE ABOVE, SINCE THE POPULARITY AND PRE-EMINENCE OF THE "POSITIVE" SLOT METER BECAME PRONOUNCED.

Reductions in Price.—The Directors of the Eckington and Mosborough Gas Company intend to reduce the price of gas from 4s. to 3s. 8d. per 1000 cubic feet. As from the 1st of July, the price of gas in the district of the Barking Gas Company will be reduced 2d. per 1000 cubic feet; making the charges 3s. 4d. to ordinary, and 4s. to prepayment meter consumers. The Altrincham Gas Company have decided to reduce the price of gas 2d. per 1000 cubic feet after the reading of the meters for the March quarter. This will make the net price 2s. 7d. per 1000 feet for lighting, and 2s. 3d. for power purposes. At Exeter, the price has been reduced by 2d. per 1000 feet as from Christmas last. At the close of the present quarter, the price of gas at Redhill will be reduced 2d., and in the district of the North Middlesex Gas Company 1d., per 1000 cubic feet.

Some Large High-Pressure Incandescent Gas Installations.—The Birmingham Corporation Tramways Department have jnst installed, for lighting their new electric tramcar sheds, a Sugg's high-pressure gas plant of 18,000-candle capacity. Messrs. Sugg and Co., are also increasing their high-pressure gas installation at the Smethwick Town Hall; and the Corporation have placed in their hands the reventilation of the Public Hall, &c. In addition to the above high-pressure installations, the same firm have just fitted in Messrs. Tangyes' erecting shops a 105,000-candle pressure increasing plant, and have now in hand the relighting of their large foundry and pattern-making shops. These installations, when completed, will make the fifth that Messrs. Tangyes have; and the whole will be capable of producing an illuminating effect of 204,000 candles.

The Gaslight and Coke Company's Discounts.—At the Court of Common Council held last Thursday, the Streets Committee presented a report relative to the announcement made by the Governor of the Gaslight and Coke Company, at the half-yearly meeting on the 5th inst., of the determination of the Directors to make a concession to large consumers and users of gas for power purposes north of the Thames, of a discount varying from 2½ to 5 per cent. off the quarterly accounts. In connection with this matter, the Governor said they could not extend this concession to any consumer, whether private or public, on the south side of the river, nor as regards public lighting accounts to the Local Authorities on the north side; and the Committee recommended that application be again made to the Company for such discount in respect of all gas supplied for public purposes to the Corporation, as successors of the Commissioners of Sewers for the City of London. The report was adopted without discussion.

Cheap Electricity for Leeds Streets.—There was a lively but friendly debate at the last meeting of the Leeds Corporation Lighting Committee. It arose out of the application of a Sub-Committee to extend the area of street lighting by electricity, and to be supplied at the rate of 1¼d. per unit, whereas the average cost to the Electric Lighting Committee for every unit manufactured was said to be 3d. During the discussion, it was admitted that electricity supplied at even 1¼d. per unit would be 25 per cent. dearer than the cost of illuminating the streets by gas used in incandescent burners. It was recalled that years ago the City Council declined to confirm a proposal that the Street Lighting Committee should be supplied with gas at a lower price than that charged to ordinary consumers. The opposition, however, failed, for by a good majority the Committee adopted a resolution that the Council should be recommended to supply electricity for street lighting purposes at 1¼d. per unit, as desired by the Sub-Committee.

Gas Lighting in West Ham.—At the meeting of the West Ham Town Council on Tuesday, a letter was received from the Gaslight and Coke Company in connection with the proposed installation of incandescent gas-burners throughout the borough. The Company suggested the adoption of the "C" burner, and offered to make a reduction of 1s. 4d. per lamp in the prices, subject, if the lamps are not satisfactory within three months, to the substitution of another burner to be approved by the Municipal Engineer. The proposed arrangement was agreed to. The subject of the testing of the gas was also before the Council. The West Ham Gas Company wrote stating that though they had fixed a 16-candle burner on the testing apparatus at the Leytonstone Road station, to meet the wishes of the Council, as expressed some months ago, they were still of opinion that clause 31 of their Act of 1902 gives them power to burn the gas at such a rate as will yield the maximum light for which the burner is capable; and that if by any chance the gas should, on testing, be below 14 candles, they would be bound to dispute the validity of the existing test. In these circumstances, they suggested that the Gas Referees should be asked, as friendly arbitrators, to decide between the Council and the Company as to the proper construction of the clause. Having taken the opinion of the Gas Examiner on the matter, it was decided to agree to the suggestion.

Lead Poisoning and Water Supplies.—Mr. Aspinall Marsden has been writing to the papers on this subject, doubtless as the result of perusing the volume recently issued by the Local Government Board, and noticed in the "JOURNAL" for the 9th ult. He expresses the conviction that lead-poisoning consequent upon acidity in public water supplies is having more disastrous effects upon people than those recently proved to be due to the contamination of beer with arsenic. His practice was formerly in Lancashire; and going into a Yorkshire district supplied with moorland water, certain remarkable differences in the appearance of various diseases attracted his attention. Anæmia was remarkably prevalent among both rich and poor; the cause, in his opinion, being small doses of lead taken in the water for a prolonged period. "Gastric" cases, too, were far more numerous than they were in Lancashire, though the habits of life in both counties appeared to be much the same. Another very decided contrast was presented in the appearance of the teeth, which in Yorkshire were notoriously bad. This was contrary to his Lancashire experience, under similar circumstances, and could only be explained, he thought, by the acidity of the water, the presence of lead, and the absence of lime. From the evidence of morbid anatomy, Mr. Marsden says, it can be readily understood how serious a deterioration of the general health may be induced by small doses of lead supplied in acid water, and how urgently the matter calls for an immediate attention.

IMPORTANT.

IF

YOU WANT QUICK DISPATCH

send all orders for

SLOT INSTALLATION FITTINGS,

PENDANTS,

BRACKETS,

INVERTED FITTINGS,

MAIN COCKS

(OF EVERY DESCRIPTION),

SYPHON AND LUBRICATOR PUMPS

TO

WILLEY & CO., LIMITED

LONDON and EXETER.

Quotations cheerfully given for all kinds of Gas Fittings.

The Thames and the London Water Supply.—At the meeting of the Thames Conservancy on Monday last week, a table was submitted giving the quantity of water abstracted from the river by the Water Companies during January. It showed that the total quantity taken was 3382·8 million gallons; the daily average being 109·1 millions. The 21 years' daily average for January was 94·7 million gallons. The natural flow of the river at Teddington Weir was 87,335·3 million gallons, or a daily average of 2817·3 millions; the 21 years' daily average being 2132·3 millions.

Gas-Engines for Pumping.—In the "JOURNAL" for the 6th of October last, we gave some particulars in regard to the installation of gas-engines at the new pumping-station of the London County Council at Lot's Road, Chelsea. The station was formally opened on the 20th ult. by the Chairman of the Council (Lord Monkswell), who mentioned that they could now deal with more than 600,000 gallons of sewage per minute. Since 1855, when the Metropolitan Board of Works was constituted, capital to the amount of £8,500,000 had been spent on the London main drainage system; and since the Council had come into existence, about £1,750,000. This sum, however, was not the end of the liabilities incurred, as, under the scheme of 1899, an outlay of £3,000,000 had been sanctioned. At the close of the inaugural proceedings, one of the gas-engines was set in motion. The cost of the station has been about £82,000, of which the buildings (erected by the Works Department of the Council) account for £50,000, the pumps (supplied by Messrs. Easton and Co.) for £6100, and the gas-engines (supplied and fixed by Messrs. Crossley Bros., Limited) for £10,300.

Messrs. John Wright and Co., of Birmingham, have just appointed Mr. David Morris, of Edinburgh, to represent them in Scotland and the North of England. Mr. Morris has for many years past been well known in the gas and kindred trades of the North.

In the Sheriff Court at Cupar, Fife, a few days ago, Thomas Condie Anderson, a young man employed by the Kirkcaldy Gas Company, was sentenced to a month's imprisonment for embezzling £100 out of £219 14s. 7½d. collected by him for the Company.

We are asked to intimate that the "Warning" advertisement issued by the Welsbach Incandescent Gaslight Company, and having reference to an injunction recently obtained in the High Court of Justice, King's Bench Division, against one Swinden, does not refer to Messrs. C. F. E. Swinden and Co., Mining Plant Manufacturers.

Dividends at the rate of 8 per cent. per annum on the 10 per cent. shares, and of 7 per cent. per annum on the 7 per cent. shares, were declared at the half yearly meeting of the West Surrey Water Company last Tuesday; and on the same day a dividend at the rate of 5½ per cent. per annum was declared on the ordinary stock of the Herne Bay Water Company for the six months ended Dec. 31.

After payment by Messrs. Crossley Bros., Limited, of dividends to June 30, 1903, amounting to £38,600, there is £80,001 for disposal. The Directors propose to pay a further dividend of 5 per cent. per annum on the preference shares, and 12 per cent. per annum on the ordinary shares (making 11 per cent. for the year), amounting to £44,303. They recommend that the invested funds be written down by £17,000, and that £18,778 be carried forward.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
MANAGER AND SECRETARY. Marsden Gas Department. March 9.
OUT DOOR INSPECTOR. No. 4173.

Situations Wanted.
LEAD BURNER. No. 4174.
SULPHATE MAKER, &c. No. 4172.
WORKING MANAGER. No. 4168.

Plant, &c., for Sale.
CONDENSER (250,000 feet). Redditch Gas-Works.
LAMP COLUMNS, LAMPS, &c. Faversham Gas-Works.
GAS LANTERNS. Lambeth Borough Council.
MOUTHPIECES, ASCENSION, &c., PIPES, FOUL AND HYDRAULIC MAIN, VALVES, &c. Ramsgate Gas Department.
RETORT IRONWORK, ASCENSION, &c., PIPES, CONDENSER, SCRUBBER, EXHAUSTER AND ENGINE, BOILER, PUMPS, VALVES, &c. Richard Smith's Executors, Glasgow.
RETORTS, GASHOLDERS, PURIFIERS, STATION METER, ENGINE SCRUBBERS, &c. Southborough Gas-Works.

Plant, &c. (Second-Hand), Wanted.
CAST-IRON TANKS (NEW OR SECOND-HAND). Bishop's Stortford Gas Company.
PURIFIERS. No. 4171.
STREET-LAMPS. No. 4170.

Company Meeting.
RICHMOND GAS STOVE AND METER COMPANY. Warrington. March 10. Twelve o'clock.

Sales of Stocks and Shares.
ALDERSHOT GAS AND WATER COMPANY. March 15.
BRISTOL WATER COMPANY. March 10.
GAS METER COMPANY. March 15.
ROMFORD GAS COMPANY. March 15.
SOUTH ESSEX WATER COMPANY. March 15.
SOUTH WEST SUBURBAN WATER COMPANY. March 15.

TENDERS FOR

Bricks.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.

Carbon.
GAINSBOROUGH GAS DEPARTMENT.

Coal and Cannel.
SALFORD GAS DEPARTMENT. Tenders by March 17.

Condenser.
BRIGHOUSE GAS DEPARTMENT. Tenders by March 5.

Drysaltery and Chemicals.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.

Elevator for Oxide.
BRIGHOUSE GAS DEPARTMENT. Tenders by March 5.

Gas Fittings, Burners, Mantles, &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.

General Stores, Ironmongery, Paints, Oils, Shovels, &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.
RHONDDA DISTRICT COUNCIL. Tenders by March 17.

Fire-Bricks, &c.
RHONDDA DISTRICT COUNCIL. Tenders by March 17.

Lamps, Columns, Brackets, &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.

Lime.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.
RHONDDA DISTRICT COUNCIL. Tenders by March 17.

Meters, &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10

Pipes (Wrought, Cast, and Lead), &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.
RHONDDA DISTRICT COUNCIL. Tenders by March 17.

Purifier Grids.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10

Retort Fittings, &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.
STAFFORD GAS DEPARTMENT. Tenders by March 11.

Stoking Tools, &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.

Sulphuric Acid.
RHONDDA DISTRICT COUNCIL. Tenders by March 17.

Tanks (New or Second-Hand).
BISHOP'S STORTFORD GAS COMPANY.

Tar.
EXETER GAS COMPANY. Tenders by March 12.

Valves, &c.
BIRMINGHAM GAS DEPARTMENT. Tenders by March 10.

Washer-Scrubber.
STAFFORD GAS DEPARTMENT. Tenders by March 11.

BOOKS AND LEAFLETS

TO BE OBTAINED OF

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

THE FLOW OF GASES AND PROPORTIONING GAS-MAINS.—By F. SOUTHWELL CRIPPS, Assoc. M.Inst.C.E. *Price 7s. 6d.*

REPORTS OF DISTRICT ASSOCIATIONS OF GAS ENGINEERS AND MANAGERS FOR 1902. *Price 5s. 6d.*

GAS COMPANIES' BOOK-KEEPING.—By JOHN HENRY BREARLEY and BENJAMIN TAYLOR, of Longwood. *Morocco Gilt*, 18s.

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ANALYSIS OF THE ACCOUNTS OF THE METROPOLITAN WATER COMPANIES (Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex), and of the CORPORATION WATER UNDERTAKINGS OF EDINBURGH, GLASGOW, and MANCHESTER, for the Year 1902-1903 By WOOD, DREW, & Co., Chartered Accountants. *Price 15s.*

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"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

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AMMONIACAL Liquor wanted by JOHN RILEY & SONS, Hapton, near ACCRINGTON.

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BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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THE First Dutch Bog Ore Co., Ltd., (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.

General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.

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(NATURAL.)

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.

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COAL GAS TAR wanted.
BEST PRICES GIVEN.

SHARPNESS CHEMICAL COMPANY, LIMITED, Sharpness Docks, GLOS.

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Offices: Commercial Buildings, LEEDS. Correspondence invited.

SPENT OXIDE.

THE South Metropolitan Gas Company are always open to receive OFFERS of SPENT OXIDE.

Chief Office: 709, Old Kent Road, London, S.E.
Telegrams: "METROGAS, LONDON."

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
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For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

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For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

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BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

TO GAS AND WATER OFFICIALS.

MELROSE CYCLES and Slot Copper COLLECTORS. Latest Design and lowest Prices. For Cash or gradual payments. Catalogue free.
MELROSE CYCLE COMPANY, COVENTRY.

LEAD-BURNER wants Situation. Willing to fill up time for constancy.
Address No. 4174, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Sulphate MAKER. Age 23. Three years' Experience. Gas-Stove Cleaning and Repairing between runs.
Address No. 4172, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS COMPANIES.

ADVERTISER seeks situation as WORKING MANAGER. 23 years' Practical Experience. Thoroughly acquainted with the Manufacture, Purification, and Distribution of Gas. Understands Gas-Fitting, Meter Inspection, Incandescent Burners, Stoves, &c. Highest References and Testimonials as to Character and Ability.
Address No. 4168, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

TO SUBSCRIBERS.

ROBERT DEMPSTER & SONS, LTD., of Rose Mount Iron-Works, Elland, Yorkshire, beg to inform Subscribers to the "JOURNAL OF GAS LIGHTING," that the series of COLLOTYPE VIEWS OF GAS PLANT executed by them is being issued in the form of inserted sheets[illegible] ortnightly, Four of which have already been published, and respectfully suggest that SUBSCRIBERS SHOULD PRESERVE THE WHOLE SERIES FOR FUTURE REFERENCE.

WANTED, by a Gas Company making about 70 Millions annually, a competent Man as TEMPORARY OUTDOOR INSPECTOR, to test district for Leakage, and Superintend Repairs in Connection with same. Applicants must be experienced in similar work and Meter Testing. Bonus given for satisfactory results.
Apply, stating Age, Experience, and Remuneration expected, with References to No. 4173, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MARSDEN URBAN DISTRICT COUNCIL.

THE above Council require the services of a competent MANAGER and SECRETARY for their Gas-Works, to devote the whole of his time to the duties of the office.
The Make of Gas is 24 Million cubic feet; and the number of Consumers 700.
Applications, stating Age, previous Experience, and Salary required, accompanied by not more than three Testimonials of recent date, to be sent to the Chairman of the Council, not later than Wednesday, the 9th day of March, endorsed "Gas Manager."
Feb. 26, 1904.

WANTED, Two Second-hand Purifiers, 8 feet or 10 feet square, and in good condition.
Apply, with Particulars and Price on Rail, to No. 4171, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, New or Second-Hand, two Cast-Iron TANKS. Capacity about 10,000 Gallons each.
Apply, stating full Particulars, to J. W. PORTASS, Manager, Gas-Works, BISHOP'S STORTFORD.

WANTED, 2 to 3 dozen Second-hand STREET LAMPS. Must be in good condition; shape not so material.
Send Particulars and Price to No. 4170, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CONDENSER for Sale. In splendid Condition. Cheap. Capacity 250,000 Cubic Feet per Twenty-four hours.
Apply to A. E. LAYTON, Manager, Gas-Works, REDDITCH.

TO BE SOLD—New Single Gasholder, 50 feet diameter by 15 feet deep, with Six Wrought-Iron Standards, top Ties, and Suspension Gear if needed. Ready for erection.
Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

FOR SALE—The Faversham Gas Company will shortly have for disposal 100 LAMP-COLUMNS, with LANTERNS and CRADLES complete.
Further Particulars to be obtained on application to the undersigned.
ARTHUR EASTON,
Engineer and Manager.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

GAS PLANT, for Immediate Sale—All Iron-Work of 52 Retorts, Ascension, Bridge, and Dip Pipes. Hydraulic Mains. One Condenser, 12-inch connections. Four Upright Scrubbers. One Beal's Exhauster and Engine, 10-inch Cylinder, with Three Pumps. A large Number of 10-inch Valves. Steam Boilers, Tanks, Pumps, &c.
Particulars from RICHARD SMITH'S EXECUTORS, Limited, 182, West Street, GLASGOW.

GAS CARBON FOR SALE Offers at once to JOHN BALDWIN, Manager, Gas-Works, GAINSBOROUGH.

SOUTHBOROUGH (TUNBRIDGE WELLS) URBAN DISTRICT COUNCIL.

THE Gas Committee have for Sale the disused RETORTS, GASHOLDERS, PURIFIERS, STATION METER, GAS-ENGINE, SCRUBBERS, and other IRONWORK lately used in the Manufacture of Gas.
Intending Purchasers are invited to inspect the same before making Offers, and applications may be made to the SURVEYOR, Council Offices, London Road, Southborough, TUNBRIDGE WELLS, who will furnish all Information.

FOR SALE—DISUSED RETORT IRONWORK.

THE Gas and Water Committee of the Ramsgate Corporation have FOR SALE, at their Gas-Works, the following disused RETORT IRON WORK connected with 14 Settings of 6 Retorts, as follows:—
84 22 in. by 16 in. Self-Sealing Mouthpieces complete, by Tangyes.
84 each Cast-Iron Ascension, Bridge, and Dip Pipes.
133 feet, or thereabouts, of 18-inch Cast-Iron Foul Main.
14 lengths of Wrought-Iron U-shaped Hydraulic Main.
14 Hydraulic Main Valves.
The whole of the above may be seen on application.
Further Particulars to be obtained from the undersigned, to whom Offers are to be sent on or before the 5th day of March, 1904.
T. N. RITSON, Assoc.M.Inst.C.E.,
Engineer and Manager.
Gas and Water Offices,
Ramsgate.

CITY OF BIRMINGHAM.
(GAS DEPARTMENT.)

TENDERS are invited for any of the STORES named in the following Lists, to be supplied to the Corporation Gas-Works in Birmingham, Swan Village, and Wednesbury, during the Year ending March 31, 1905.

Bolts, Nuts, &c.
Brass Fittings.
Brass and Gun-Metal Castings.
Brass Padlocks.
Brushes.
Canvas Hose, Belting, &c.
Clothing.
Coke Bags, Shoots, &c.
Drysaltery, Paint, and Chemicals.
Engine Packing.
Files, Steel, Steel Tools, &c.
Galvanized-Iron Buckets and Pipe.
Gas-Fittings.
Glass.
Gauge Glasses and Lubricators.
Hand Lamps.
India-Rubber Goods, Hose, &c.
Iron Barrows.
Iron Castings, Machined or Fitted.
Iron Chains.
Ironmongery and Wood Screws.
Lamp Columns.
Leather Bags.
Leather Belting, Stokers' Mitts, &c.
Malleable Iron Castings.
Meter Stays, Pipe Hooks, Lamp Brackets, and Valve Keys.
Nails, &c.
Oils, Lubricants, &c.
Pressure Gauges.
Purifier Grids.
Retort Lids, Mouthpieces, and Fittings.
Riddles.
Ropes, Flax, &c.
Scouring Flannel and Dusters.
Shovels, Forks, and Stokers' Tools.
Slates.
Street-Lanterns.
Thermometers.
Timber, Meter Boards, &c.
Tools, &c.
Valves, &c.
Wood Turnery.
Wire Ropes.
Wrought Iron Work, Forgings, &c.

N.B.—The Stores in the foregoing List include Articles to be supplied to samples, which will be shown at my Offices on March 2, 3, and 4, from Eleven a.m. to Four p.m.

Boiler Composition.
Brass Sheet, Tubes, and Rods.
Bricks (Brown).
Cast-Iron Pipes.
Cement, Lime, &c.
Copper Bars, Gauze, and Sheets.
Cotton Waste and Sponge Cloths.
Incandescent Burners and Mantles.
Iron and Steel Bars and Sheets.
Iron (Gas and Steam) Tubes and Fittings.
Iron Borings.
Lime for Purifying.
Oatmeal.
Meters.
Paving Stones.
Red and White Lead.
Roofing and Boiler Felt.
Tin Plates and Sheets.
Tin, Lead, and Compo. Tube.
Zinc Sheetings and Scrap.

Conditions and Forms of Tender, price 5s. each (this amount to be returned on receipt, on or before March 10, of a *bonâ-fide* Tender, in accordance with the Conditions, for any portion of the Stores), may be obtained at my Office.
Separate Forms of Tender are issued for each Contract, and applicants must specify the Forms required.
G. HAMPTON BARBER,
Secretary.
City Gas Offices, Council House,
Feb. 27, 1904.

TENDERS FOR TAR.

THE Directors of the Exeter Gaslight and Coke Company invite TENDERS for their surplus TAR for Twelve Months from the 25th of March next, at per Ton of 200 Gallons, delivered into Contractor's Tanks at the Company's Works.

Sealed Tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Saturday, the 12th of March next; but the Directors do not bind themselves to accept the highest or any Tender.

By order,
W. A. PADFIELD,
Engineer and Secretary.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply of the COAL and CANNEL required at their works during a period of One Year.

Forms of Tender may be obtained on application to Mr. William W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.

Sealed Tenders, endorsed "Tender for Coal," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three o'clock on Thursday, the 17th of March, 1904.

L. C. EVANS,
Town Clerk.

Town Hall, Salford,
Feb. 24, 1904.

BOROUGH OF BRIGHOUSE.

THE Gas Committee of the Brighouse Corporation invite TENDERS for the supply and fixing at Mill Lane Gas-Works, of—

CONTRACT No. 1.
CONDENSER, Capacity 1 Million Cubic Feet per day.

CONTRACT No. 2.
WASHER-SCRUBBER, Capacity 1 Million Cubic Feet per day.

CONTRACT No. 3.
OXIDE ELEVATOR for Purifying House.

Further Particulars can be obtained from the Gas Engineer.

Tenders to be sent in not later than March 5, endorsed 'Contract 1, 2, or 3," as the case may be.

No allowance for Tenders, and the Committee do not bind themselves to accept the lowest or any Tender.

By order,
JAMES PARKINSON,
Town Clerk.

Municipal Offices, Brighouse,
Feb. 22, 1904.

STAFFORD CORPORATION GAS-WORKS.

THE Gas and Electricity Committee of the Stafford Corporation are prepared to receive TENDERS for the supply of RETORT-BENCH MOUNTINGS, BUCKSTAYS, &c.

Copies of Specification and Quantities may be obtained from the undersigned on payment of Two Guineas, which will be returned on receipt of a *bond-fide* Tender.

Drawings may be inspected at the Gas Offices, or a set of sun-prints of the Drawings may be obtained from the undersigned on payment of One Guinea, which will not be returned.

Tenders, endorsed "Retort-Bench Mountings," to be lodged at the Gas Offices not later than Friday, March 11, 1904.

The Committee do not bind themselves to accept the lowest or any Tender.

HUBERT POOLEY, Assoc.M.Inst.C.E.,
Engineer and Manager.

Gas Offices, Chell Road,
Stafford, Feb. 23, 1904.

BOROUGH OF LAMBETH.

SECOND-HAND GAS-LAMP LANTERNS.

THE Lambeth Borough Council are pre- pared to receive TENDERS for the purchase of a quantity of Second-hand LANTERNS, approximately 380, mostly of the "Kingston" pattern, formerly in use on the Public-Street Lamps, the Tenders to be either for all the Lanterns in one lot, or in separate lots of 25 Lanterns each.

The Lanterns may be inspected at the Council's Depôt, Cobbett Street, Dorset Road, Clapham Road, S.W., on application to the Manager; and all further Information may be obtained from Mr. Henry Edwards, C.E.

Tenders, endorsed "Second-hand Lanterns," are to be delivered to the undersigned not later than Twelve o'clock noon on Thursday, the 17th of March, 1904.

HENRY J. SMITH,
Town Clerk.

Lambeth Town Hall,
Kennington Green, S.E.,
February, 1904.

BOROUGH OF MACCLESFIELD.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee are prepared to re- ceive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Works during the Twelve Months commencing the 1st day of April next.

Tenders for the Tar or Liquor separately to be sent in not later than Monday, the 14th day of March, 1904, addressed to the Chairman of the Gas Committee, Town Hall, Macclesfield, and endorsed "Tender for Tar, &c."

For Conditions, apply to Mr. E. L. Newbigging, Engineer, Gas-Works, Macclesfield.

The Committee reserve to themselves the right of accepting any Tender for the Tar or the Liquor separately.

The highest or any Tender not necessarily accepted.

ARTHUR T. PATTINSON,
Town Clerk.

Feb. 17, 1904.

TAR Contracts Wanted on the Sliding- Scale or at Fixed Prices.

Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

RHONDDA URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

THE above Council are prepared to re- ceive TENDERS for the supply of LIME, ACID, FIRE-BRICKS, GAS, WATER, and GUN METAL FITTINGS, OILS and PAINT, IRONMONGERY, BOOKS, and STATIONERY, &c., as may be required for the Year ending the 31st of March, 1905. Also, for WROUGHT-IRON TUBES, and LEAD and COMPO. PIPES for the Half Year ending the 30th of September, 1904.

Further Particulars and Forms of Tenders may be obtained on application to the Engineer and Manager, Mr. Octavius Thomas, Gas and Water Offices, Pentre, R.S.O., Glam.

No Form of Tender other than issued by the Council will be accepted.

The Contractor will be required to pay the Standard rate of Wages recognized in the district.

Tenders, endorsed "Contract No. 1, 2, &c.," as the case may be, addressed to the Chairman of the Gas and Water Committee, to be sent to the undersigned on or before Ten a.m. on Wednesday, the 16th of March.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER P. NICHOLAS,
Clerk.

Gas and Water Offices, Pentre,
R.S.O., Glam, Feb. 27, 1904.

THE RICHMOND GAS STOVE AND METER COMPANY, LIMITED.

NOTICE is Hereby Given, that the ANNUAL ORDINARY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, Academy Street, Warrington, on Thursday, the 10th day of March, 1904, at Twelve o'clock noon, precisely, to receive the Report of the Directors and the Accounts of the Company for the year ended the 31st day of December, 1903, to declare a Dividend, to appoint Auditors, and to transact any other business proper to be dealt with at an Ordinary Meeting.

AND NOTICE IS HEREBY FURTHER GIVEN, that an EXTRAORDINARY GENERAL MEETING will be held at the close of the Ordinary Meeting for the purpose of passing the following Resolutions:—

RESOLUTIONS.

1—"That the existing 12,500 £1 Preference Shares in the Capital of the Company be consolidated in such manner that every five of the said Shares shall constitute one £5 Preference Share, upon which the sum of £5 shall be credited as having been paid up."

2—"That the existing Certificates of the said Preference Shares be called in by the Directors and cancelled, and that New Certificates be issued subject to the provisions contained in the Articles of Association."

The TRANSFER BOOKS OF THE ORDINARY SHARES WILL BE CLOSED from the 3rd of March to the 11th of March inclusive.

By order,
JAS. W. SLACK,
Secretary.

132, Queen Victoria Street,
London, E.C., March 1, 1904.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALDERSHOT GAS AND WATER COMPANY.

NEW ISSUE OF 350 £10 FIVE PER CENT. "G" PREFERERCE SHARES and 350 £10 "G" ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, March 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors of the
SOUTH ESSEX WATER-WORKS COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the MART, E.C., on Tuesday, March 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

GAS AND WATER PREFERENCE AND ORDINARY SHARES

IN THE

SOUTH WEST SUBURBAN WATER COMPANY,
ROMFORD GAS AND COKE COMPANY, LTD.,
GAS METER COMPANY, LIMITED.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, March 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

NOTICE TO CREDITORS AND CLAIMANTS.

IN THE MATTER OF THE BALLYMENA AND HARRYVILLE GASLIGHT COMPANY, LIMITED.

(IN LIQUIDATION.)

NOTICE is Hereby Given, that Special Resolutions of the above-named Company were duly passed and confirmed on the 3rd day of February, 1904, and the 20th day of February, 1904, respectively, for the voluntarily Liquidation of the Company.

All persons being creditors of, or having claims against, the said Company, are required, on or before the 21st day of March, 1904, to send their names and addresses and the Particulars of their Debts or Claims to us, as Liquidators of the said Company, at the address given below.

Dated this 20th day of February, 1904.

WILLIAM LESLIE,
SAMUEL HOOD,
JOHN WIER,
} Liquidators.

Address, 10, Wellington Place,
Belfast.

BRISTOL WATER-WORKS COMPANY.

SALE OF ORDINARY STOCK.

MESSRS. ALEXANDER, DANIEL, AND CO. will SELL BY AUCTION, at the Bank Auction Mart, Corn Street, Bristol, on Thursday, March 10, 1904, at Three o'clock in the Afternoon,

£15,000

BRISTOL WATER-WORKS 7 PER CENT. MAXIMUM CONSOLIDATED ORDINARY STOCK, in Lots of £100,

At the reserved price of £147.

The above £15,000 Stock is part of the 7 per cent. Maximum Consolidated Ordinary Stock, amounting to £690,000, created under the powers of the Bristol Water-Works Acts, 1888, 1889, and 1895.

The Dividend is subject to proportionate diminution whenever the Maximum Dividend to which each class of Ordinary Shares or Ordinary Stock of the Company is entitled shall not be paid in full, but such diminution may be made up in subsequent years.

For further Particulars and Conditions of Sale, apply to the AUCTIONEERS, Bank Chambers, Corn Street, BRISTOL; to Messrs. EDWARD GERRISH AND CO., Lloyd's Bank Buildings, Corn Street, BRISTOL; or to

ALFRED J. ALEXANDER,
Secretary and General Manager.

Bristol Water-Works Office,
Telephone Avenue, Bristol.

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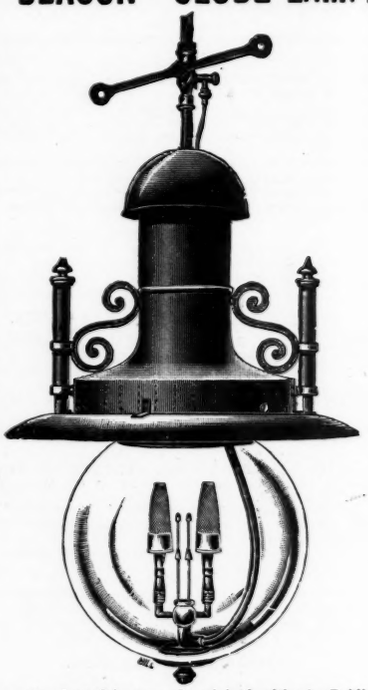
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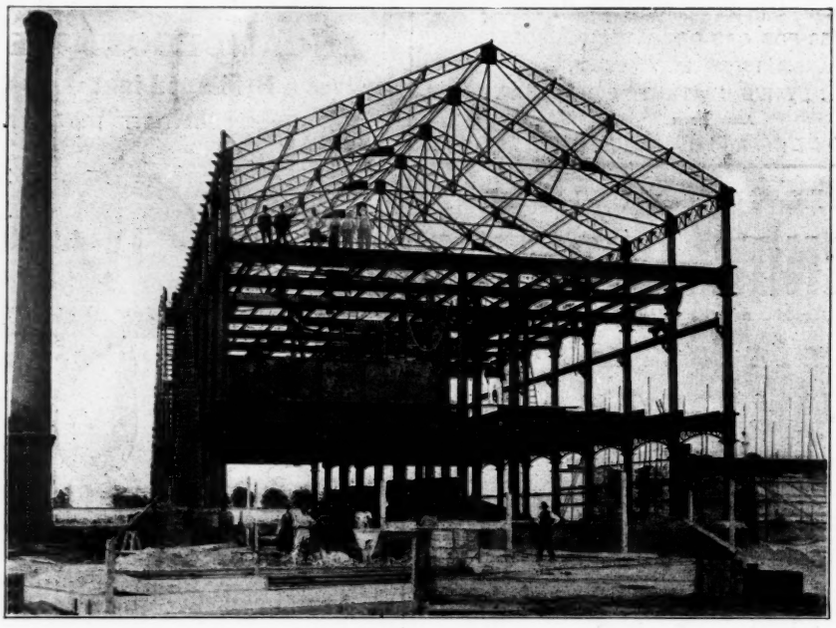

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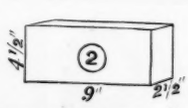

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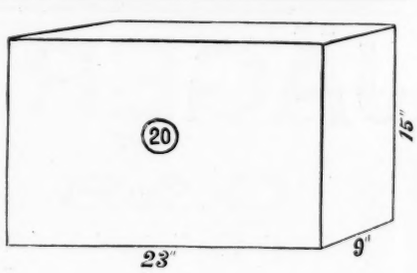

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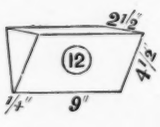

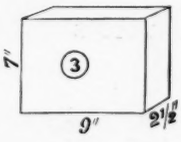

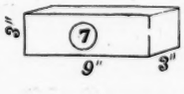

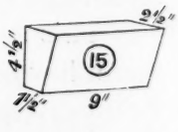

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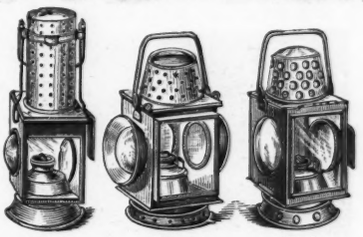

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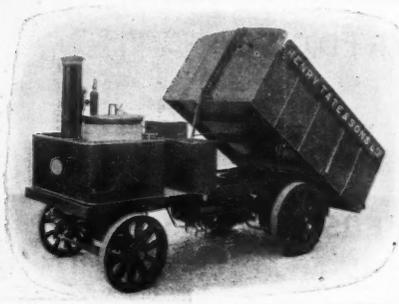

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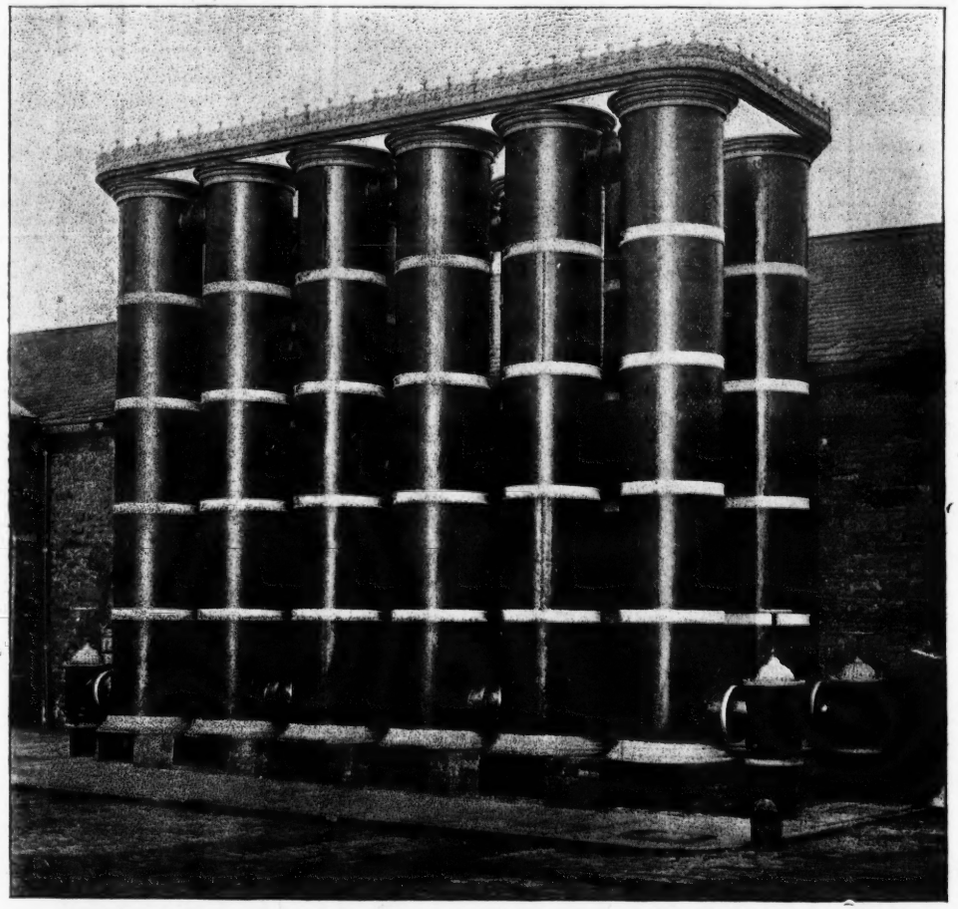

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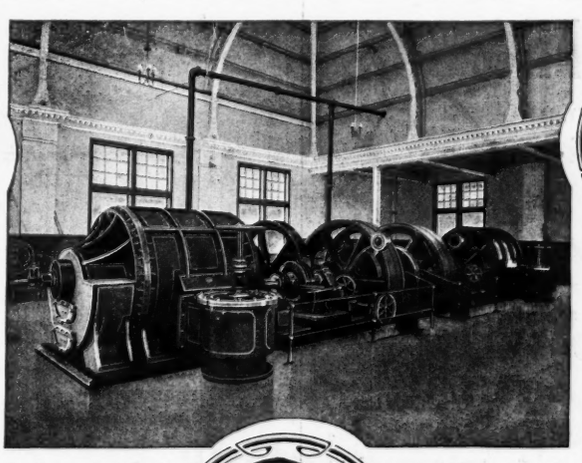

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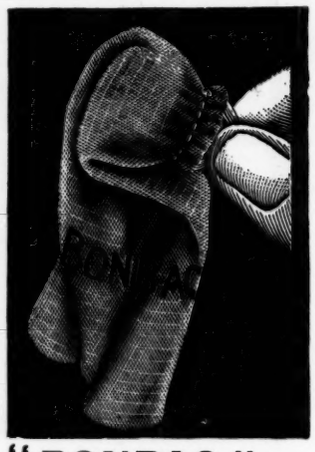

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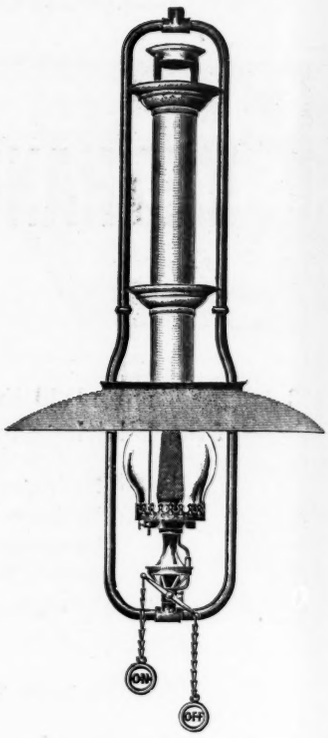

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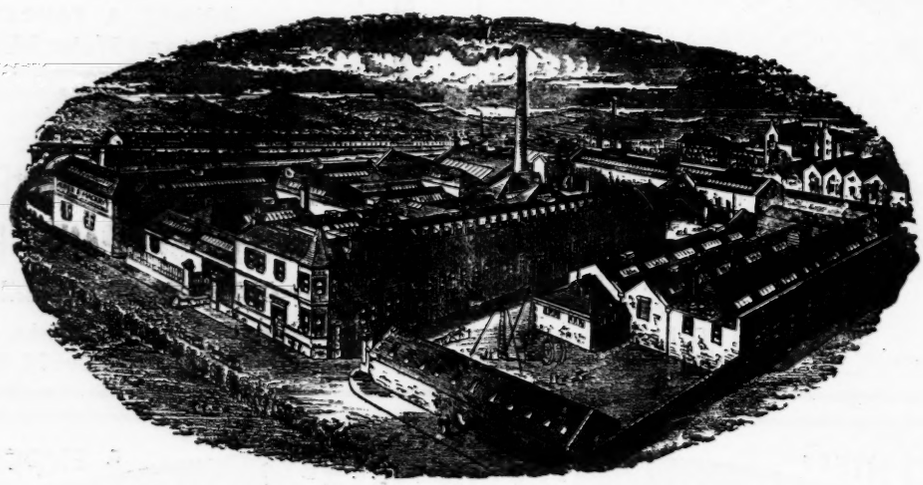

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